The
GEOGRAPHICAL JOURNAL

Vol XCIII No 5 R.G.S. *May 1939*

EXPLORATION OF ANCIENT SITES IN NORTHERN AFGHANISTAN

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Evening Meeting of the Society, 6 February 1939

IT has long been the custom of this Society to give, through the Expedition Fund, assistance to Fellows for exploration and research. As one of those who have benefited by this generosity, it is my privilege this evening to give you an account of the work of a small expedition which made last summer an archaeological exploration in those regions where the Oxus flows from "his high-mountain cradle in Pamere," and where, many centuries ago, the civilizations of China, India, and the Mediterranean met. It was along the highroads of Central Asia that Buddhism, taking with it some of the forms of hellenistic art, went, in the first centuries of our era, to China, and that, in the other direction, silk caravans made their way to the markets of the Roman Empire. A glance at the map of Asia will show the routes along which these different civilizations travelled.

The valley of the Wei Ho is China's natural gateway. Going west from the ancient watch-towers of Tunhwang, two routes skirt the arid and uninhabited interior of the Tarim basin. One route passes the depression of Turfan, and follows the string of oases on the northern rim of the desert to Kashgar. The other route runs along the southern edge of the Tarim basin to Khotan. There is no evidence that the direct passes across the Karakoram to India were used in ancient times, but there were three ways across the Pamir massif. One of them, which for various reasons I shall not discuss, went from Kashgar to Ferghana and Samarkand across the Terek pass; the second, which was the silk route described by Ptolemy, ran from Kashgar through the divide between the Alai and Trans-Alai ranges, and reached Termez on the Oxus by the valley of the Waksh; the third is that of the Upper Oxus and Wakhan, which was the shortest way from Khotan to Badakhshan and Balkh. This last was the route followed by the Chinese pilgrim Hiuen Tsiang, on his homeward journey, and by Marco Polo; and in the course of

this paper I shall suggest some reasons why it may have been perhaps the most important of all.

Ancient Bactria is the plain, now partly a desert and partly covered with thorn and camel-scrub, between the Hindu Kush and the Oxus. It was bounded on the east by the Pamir massif, and on the north-west it was joined to the vast Eurasian steppe by Margiana (with its ancient capital of Merv) and Sogdiana (Samarkand), marginal areas of mixed cultivation and pastoral economy. In Bactria the route from the Mediterranean, which ran along the northern edge of the central desert of Persia, and the road from India up the Khyber pass and the Kabul valley met the great highways from China described above. Just as the Pamirs are the nodal point of the mountain systems of Asia, Bactria was the meeting-point of three peripheral civilizations.

It will be observed that all these routes pass through the narrow strips of cultivation which fringe the great desert belt, except where they cross the great barrier of the Pamirs and the Hindu Kush by narrow fertile valleys. Scattered along these fringes of cultivation between the mountains and the desert, there is a certain amount of archaeological evidence to show how civilizations came and went. Our expedition, which numbered four, and which left England at the end of May 1938 under the auspices of the Indian Section of the Victoria and Albert Museum, divided its time and its forces between the excavation of Buddhist monasteries in Swat and a reconnaissance in the north of Afghanistan.[1] But I hope that, in speaking to-night of our work in Afghanistan, you will allow me to discuss some of the raw material of history which has come from other places on these great highways. For the lands between the Indus and the Oxus, and between the Caspian and the frontiers of China, form one vast canvas which, if we are ever to write the history of Central Asia, we must try to look at as a whole.

Almost a quarter of a century has elapsed since Sir Aurel Stein and the late Professor Le Coq returned from their last great expeditions to Central Asia. Since the War political conditions have been most unfavourable to British archaeological enterprise in all the territories beyond the administered frontier of India. Eighteen months of preparation by letter and telegram did little more than extinguish our hopes of reaching Chinese Turkistan, our original goal. But when my companion, W. V. Emanuel, and I arrived in Kabul from Swat at the end of July, the difficulties, so large when seen from London or even from Peshawar, were resolved in one conversation with the Afghan Foreign Minister, H.E. Sirdar Faiz Muhammad Khan, himself a scholar keenly interested in the exploration of his country. As the first British archaeologists to enter Afghanistan, we received a warm welcome, and I cannot speak too highly of what the Afghan officials in outlying parts of the country did to further our work, or of their kindness and solicitude for our comfort. In 1922 the French obtained a virtual monopoly of archaeological research in Afghanistan. It is less than a year since, in this same hall, M.

[1] A brief account of the excavations in Swat will be found in the *Journal* of the Royal Society of Arts (vol. 87, no. 4490, 9 December 1938), and illustrations in the *Illustrated London News*, 24 December 1938. The detailed report, both of excavations in Swat and of the reconnaissance in Afghanistan, will appear as a volume in the *Memoirs* of the Archaeological Survey of India.

Hackin described the most recent work of his Mission. No words of mine can pay tribute to his generosity in giving us his support, and securing that of the French Government, for our proposals for work in Badakhshan, an area into parts of which the French archaeologists, occupied with their great tasks in other parts of the country, had not yet penetrated. Such a generous spirit of international collaboration is unhappily comparatively rare to-day in the world of science.

We set out from Kabul in a new Chevrolet car, a party of five—Emanuel, myself, an Afghan interpreter, an Indian servant, and a Kabuli chauffeur. We crossed the Hindu Kush by what is probably the highest motor-road in Europe or Asia (Shibar pass, 10,500 feet), built by the Afghan Government in 1932–33. This magnificent road, which is kept open all the year round, is the only link for wheeled traffic between Kabul and Afghan Turkistan, but the way which it follows from Bamiyan to the Oxus plain, down the gorges of one of the main feeders of the Kunduz river, is not even marked as a camel track on our latest map. Mazar-i-Sharif and Balkh are now within two days' journey of Kabul. Russian petrol reaches the Khyber pass, and all kinds of Japanese goods, imported through India, fill the bazaars of the Oxus territories. The Far East is still in touch with Bactria. But the motor lorry, which is fast driving the camel from the ancient mountain highways of Asia, brings at least one evil. Cholera was raging in Badakhshan last summer, although the Afghan Government was making most praiseworthy efforts to establish a quarantine and scientific control.

Let us now see where Bactria lies on our archaeological map, for it is only by combining the scattered pieces of evidence which are the historian's chief raw material during the ten centuries between Alexander's conquest and the Islamic invasions that we can make a coherent story. Greek kings ruled in Bactria for two centuries after Alexander had conquered Asia west of the Indus and the Pamirs, and Greek dynasties survived for perhaps another one hundred and thirty years between the Hindu Kush and the Indus. Their story is known only from their coins, of which thousands of examples exist, and from episodes referred to by classical writers, whose knowledge, after Parthia had driven a wedge between the Mediterranean world and the hellenic outposts of Middle Asia (*c.* 150 B.C.), is fragmentary.[1] Chang K'ien, whose mission (138–126 B.C.) brought China into contact with the West, gives a cross-section of Bactria in the last years of Greek rule, and after that the Chinese sources give some help; but in later centuries their information is usually limited to the comparatively brief periods in which the Chinese were in direct control of the Tarim basin or maintained outposts or embassies in Ferghana.[2] We have, for

[1] In a recent work, 'The Greeks in Bactria and India' (1938), Dr. Tarn has made all that is at present possible of these materials. Some criticisms may be made of his reading of the archaeological evidence which is of fundamental importance for an estimate of the legacy of the Greeks in India. I discuss one point below (p. 382, note 6). By his reference to "a brief visit of the French to Balkh" (p. 71) Dr. Tarn does less than justice to M. Foucher's excavations there, which lasted eighteen months.

[2] The relevant passages of the chief Chinese sources were published in an English translation by F. Hirth, 'China and the Roman Orient' (1885). G. F. Hudson, 'Europe and China' (1931), has done a good deal to relate them to the classical and Byzantine sources. But much has still to be done in this direction, especially by fitting into the

instance, no exact information as to when and how Buddhism was introduced into China, although we know how the silkworm was smuggled to Khotan and later into the Byzantine Empire.

The Greeks in Bactria were overthrown by hordes from Central Asia; the repeated invasions of nomadic peoples, Sakas, Kushans, Ephthalites, and Turks, are the chief landmarks in the history of Bactria down to the Islamic invasions (the end of the period under consideration), and long after. Precipitated, generally as a function of a much wider movement on the Eurasian steppe, into the settled plains and fertile valleys, some of these hordes reached India to rule on the Ganges, others were checked by the Hindu Kush, or, after crossing it, lost their identity and were submerged in the tide of Indian history, as the Greeks had been before them. When we know more about the society, political systems and powers of resistance of the peoples in Bactria and India who were successively overthrown by these nomad invasions, the historian may perhaps claim a hearing on the fascinating question of climatic periodicity. At least he may have something to say about the relative importance of the new doctrine which a recent disciple has added to the orthodox canon of Huntington's theories: namely, what Professor Toynbee calls the "human" or "individual" element in this cyclic process, the breakdown and disintegration of sedentary civilizations which "pull nomads out of the steppe." [1] In leaving the explanation of the rhythm of Bactrian history to our climatologists or their critics (the rhythm itself is an obvious fact of history), I may observe that what little we know of the sedentary peoples of northern Afghanistan during this period suggests that a nomad conquest brought chiefly a change of masters. In the country between the Indus and the Oxus civilization was repeatedly shaken by the nomads, but we must not assume that its course was fundamentally altered by their inroads or their ephemeral empires. The Kushans were, for example, converted to Buddhism. Hiuen Tsiang, who traversed these regions just fifty years before the Islamic invasions, speaks of the savagery of the Ephthalites; but the pious pilgrim still had the pleasure of recording the existence of some thousands of Buddhist monasteries as he passed through Bactria and Gandhara. In his time the Turks were content with a general supremacy over a large number of petty kings, not all of whom were Turks. It was left to Genghis Khan to earn the title of the "Great Destroyer."

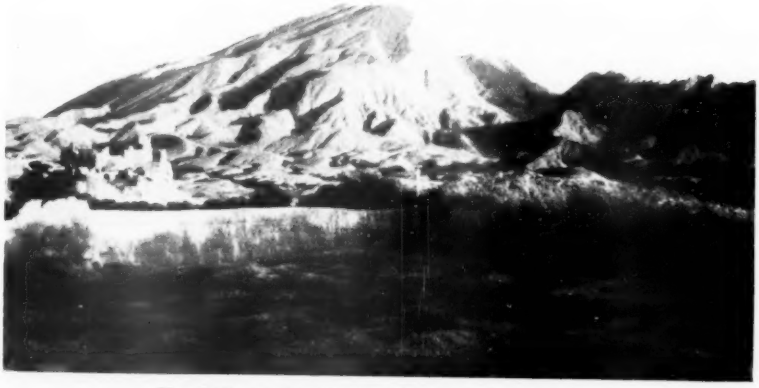
So much for the background; let us now consider the archaeological evidence that can be plotted on the map. We must begin on the Indian frontiers. Ancient Gandhara, which stretched from Taxila on the edge of the Indus plain to Kabul, included to the north the territories of Swat and Buner. The museums of Europe and Asia contain hundreds of examples of Greco-Buddhist sculpture, from Bacchic scenes which tell stories like those found on many a Greek vase to turbaned bodhisattvas, statues of Indian princes

scheme of general history the evidence of the documents recovered by pre-War expeditions from Central Asia, many of which have not yet been published. The lack of a definite equation between Chinese, Sanskrit, and classical topography and terminology is still a serious handicap.

[1] A. J. Toynbee, 'A study of history,' III. pp. 7–50 and 391–454, 1934. *Cf. Geogr. J.* 91 (1938) 1–16.

Shibar pass, Hindu Kush

Ruined city near Bamiyan



Foothills of the Hindu Kush at Tashkurghan

The Afghan mail lorry between Peshawar and Kabul

The expedition car crossing the Kunduz river

Expedition caravan in Badakhshan

which show Greek influences only in some of the conventions of the dress. There is a time lag here which we cannot explain, for the reign of Hermaeus, the last of the Greek kings who ruled in any part of India or Middle Asia, came to an end about the turn of our era, and it is impossible, for various reasons, to assign a single piece of Greco-Buddhist sculpture to a much earlier date, and some of the material may belong to the fifth century A.D. Nearly all of what we have is the by-product of military penetration or the work of the ubiquitous Pathan treasure-seeker; most of the pieces of sculpture have no better pedigree than the labels which they acquired in the Peshawar bazaar. By calling the Greekish figures early, and the more Indian types late, we can work out a chronology based on considerations of style alone, as M. Foucher did in his monumental work ('L'art gréco-bouddhique du Gandhara,' 1905–22), but a scheme based on such abstract methods can be contradicted by the archaeologist at almost every turn. In Swat for instance we found "Indian" Buddhas, with moustache, expressionless faces, and a squat and rather ugly appearance, in closest association with scenes in relief which were "classical" in style. Scientific excavation on the North-West Frontier has really only begun with Sir John Marshall's labours at Taxila, of which we still await a detailed report. Work at other sites in different parts of Gandhara may enable us to arrive at the beginnings of an archaeological, as distinct from a stylistic, chronology.

The Buddhist civilization of the oases of the Tarim basin owes at least the genesis of its art to Gandhara and Iran; nothing is more surprising than that Chinese imperialism should have left so few traces on the art and archaeology of the country west of Tunhwang before Turkistan became a land of Turks. But here again there are fundamental difficulties of chronology. It was not until Sir Aurel Stein went as far east as Loulan (which was not of course a monastic site) and the watch-towers of the Tunhwang *limes* that he had any considerable amount of data more solid than that of coins and documents found, not in the sites themselves, but in neighbouring rubbish-heaps. But there is also much more difficult ground than this on which we have to tread in appraising the archaeological evidence. The results of the four expeditions of Grünwedel and Le Coq, which brought back to Berlin a splendid selection of the paintings from the cave monasteries of Turfan and Kucha, are really a *jeu d'esprit* of the art critic, largely divorced from the facts and methods of archaeology.

During the last fifteen years discoveries made by the French in Afghanistan have raised two serious objections to the accepted archaeological chronologies of the Tarim basin, and therefore to the scheme of historical events that has been deduced from them. In the first place, the study of the cave paintings of Bamiyan has given us a number of "fixed points" and done much to alter our conception of the origins and development of what has been called Sassanian Buddhist painting.[1] M. Hackin showed by his brief examination of the Basalik site near Turfan, when he accompanied the Citroën-Hardt expedition

[1] J. Hackin, A. Godard, and Y. Godard, 'Les antiquités bouddhiques de Bamiyan,' 1928; J. Hackin and J. Carl, 'Nouvelles recherches archéologiques à Bamiyan,' 1933; J. Hackin, 'L'art bouddhique de Bamiyan dans ses rapports avec l'art bouddhique de l'Asie Centrale,' 1932.

through Chinese Turkistan in 1931, how much could now be done, with our present knowledge, to revise Grünwedel's theories.[1] I shall not discuss this problem here, for, apart from what we have at Bamiyan and in the Tarim basin, no examples of Sassanid painting exist.[2] Secondly, excavations at Hadda, a series of sites in the Jalalabad basin, have produced hundreds of figures, more Roman than Greek in type, which, as the coin evidence shows with a singular lack of ambiguity, date from the fifth, or perhaps even the sixth, century.[3] This late Gandharan material, represented at other sites on both sides of the Khyber pass, is almost certainly the result of a new wave of trade and cultural influence along the late Roman frontier, which is also illustrated by M. Hackin's amazing finds of fourth-century Syrian glass objects at Begram in the Kabul plain,[4] and perhaps by the large number of Roman coins found at places such as Sar-i-Pul on the northern flank of the Hindu Kush.[5] With few exceptions, the whole gallery of Hadda types, the Buddhas, the heavily ornamented bodhisattvas, the barbarian warriors, the stately benefactors, even the caricatures and demons, are the ancestors of those we find in the Tarim basin at most of the sites from Khotan to Turfan. As Hadda is a fixed point in our scheme (fifth century),[6] it follows that the art of Chinese Turkistan must be much later than was suggested by the inconclusive evidence hitherto available.

The Buddhist civilization of the Tarim basin was a synthesis of Iranian and Indian elements. As the two objections to accepted chronologies discussed above concern Indian sculpture and Sassanian Buddhist painting, they are clearly fundamental. Hadda has supplied a wealth of comparative material the meaning of which only renewed excavation in Chinese Turkistan can illustrate and explain. In the meantime, if you will allow me perhaps to oversimplify both the passage of Buddhism from India to China and the archaeology of Central Asia, our chief problem is this: How did the plaster sculpture of Hadda reach Khotan and Turfan? Until we can fill in the missing links, this is mainly a question of geographical probability, and it was one of the chief problems that we had in mind when we reached the north of Afghanistan.

When, at a place called Pul-i-Kumri, we emerged on to the plain of Bactria from the last defile in the foothills of the Hindu Kush, we became prospectors

[1] J. Hackin, 'Recherches archéologiques en Asie Centrale,' 1931.

[2] Professor Herzfeld's excavations at the site of Koh-i-Khwaja in Seistan, paintings from which Sir Aurel Stein brought back in 1915 and which he described as Sassanid Buddhist work, have shown that the place was a Parthian fire-temple. Stein, 'Innermost Asia,' II, pp. 909–25, 1928; Herzfeld,' Archaeological history of Iran,' pp. 58–74, 1935.

[3] J. Barthoux, 'Les fouilles de Hadda,' 3 vols., 1930–35.

[4] Preliminary report in the *Revue des Arts Asiatiques*, vol. 12, 1938. Photographs in the *Illustrated London News*, 6 August 1938.

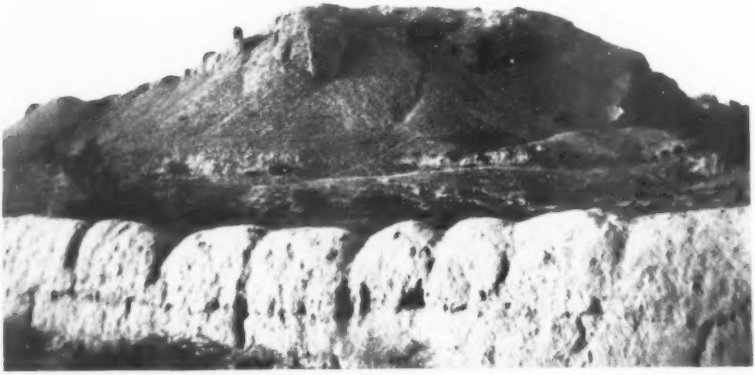
[5] *J. asiat.* 226 (1936) 292.

[6] Dr. Tarn's suggestion ('The Greeks in Bactria and India,' p. 398) that the stucco heads at Hadda were "cast in old hellenistic moulds and then attached to the fourth century A.D. bodies" is unlikely to be accepted by any archaeologist. It was inspired by some remarks of M. Foucher on one of the Hadda statues (*Mon. et mem. Fond. Piot* 30 (1929) 101ff.). Apart from the obvious improbabilities of such a theory, no mould was found during the systematic excavations at Hadda. That the heads and bodies were made separately and by different methods is of course clear.

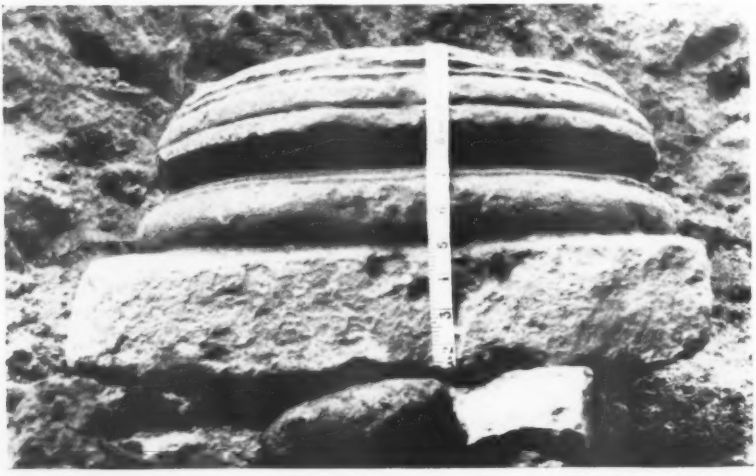
The shrine at Mazar-i-Sharif

Beginnings of a sugar factory, Pul-i-Kumri

Ancient irrigation canals near Balkh



Remains of an ancient city near Akcha, Afghan Turkistan



One of a row of hellenistic columns found at Kunduz

in a country parts of which no archaeologist has visited. Leaving the great north road, which turns north-west and crosses another spur of the mountains to reach Mazar-i-Sharif, we struck due north along a bumpy track to Khanabad. At Baghlan, a few miles farther on, we came upon the site of a sugar factory, marked, not by any habitation or structural foundations, but by a signpost in Persian and in French, and by an array of rather derelict crates and pieces of Czechoslovakian machinery, dumped on the steppe by the lorry drivers at the end of their 600-mile journey from the railhead at Peshawar. Although more than half the population are nomads, Afghanistan has not escaped the beginnings of industrialization, largely as a result of Germany's enterprise and generous credits. There is electricity at Kabul and Herat, a huge hydro-electric scheme at Pul-i-Kumri installed by Siemens, which is to feed a textile factory, and four cotton refineries in the Oxus territories, built and equipped by Russian engineers. But after we had passed through a belt of cultivation, mostly of sugar beet, the country was empty, except for occasional clouds of dust, which took shape as groups of horsemen or as great flocks of sheep whose skins are the chief wealth of Afghanistan in the world market.

Our purpose was to find out what surface ruins exist, what sites might be worth excavation, what objects have been found locally, and to collect geographical data, ancient and modern. Our itinerary was determined by the desire to investigate a number of centres where there was some *prima facie* geographical or historical reason to suppose that ancient remains might exist, but it had to be elastic, for progress in any direction depended on the willingness of the local authorities to remove the political obstacles which have always lain in the way of British travellers on the frontiers of Russian Central Asia. Our methods were necessarily haphazard. We took with us no spades, we had neither time nor permission to dig, and in any case, excavation is not possible until sites which are worth digging have been found. In every village or nomad encampment we stopped and asked the inhabitants whether they knew of any ancient sites (*Kafirkalas* or "places of infidels"), or whether, in ploughing the fields, or in any other way, anything old had been found. We had a set of photographs of seals and other objects to show the kind of things for which we were looking.

It was slow and patient work, sitting for hours in the village conclave over endless cups of tea, exchanging courtesies and trying to convince these simple people that we were not the tax-collector or the conscription officer in disguise, just as, in the towns, we had to convince zealous officials that we were not secret agents, and that archaeology really could be a profession. Much time was of course wasted on false scents; Chinese or Russian coins are "old" to the Afghans of to-day, and Muhammadan graves or rocks worn into strange shapes by the weather had naturally aroused what antiquarian interest these peasants and shepherds have. But the generous hospitality of Afghans, Turkomen, Tajiks, and Uzbegs is a thing never to be forgotten, especially as to the people north of the Hindu Kush the existence of *Inglistan* is unknown: their information about Europe is usually limited to Germany and Russia.

We passed through Khanabad, a town of recent growth, where not even a

single ancient coin relieved the drab monotony of our hunt through the Russian crockery, Japanese cotton goods, and German alarm clocks of the bazaars, to Kunduz, where these methods were luckily crowned with success. This small town, with its new and well-kept streets, was an important place in Hiuen Tsiang's time, and again last century, when Wood had a good deal to say about the Uzbeg chief who had carried off so many of the inhabitants of the Badakhshan uplands to die in the pestilential marshes surrounding his capital. Here we sat for many hours in the bazaar, as we so often did, waiting until our presence and our mission were noised abroad throughout the town.

An old man who had paid no attention to us, and who had been just one of the expressionless bearded faces that filled the *Tschaikhana*, suddenly spoke up, saying that he had something which might be of interest to us, though he could not say what it was. He led us to his house on the outskirts of the town, a substantial dwelling in the shape of a caravanserai. In the courtyard stood the bases of two Greek or Roman columns of Corinthian style. He took us farther up the street to a pit dug by builders to get earth for making bricks. There, at a depth of 10 feet, a third column base was just being unearthed. This is the first ancient stonework found to the north of the Hindu Kush, the first Greek remains seen in Central Asia. Only excavation will show what they are—perhaps the edge of a forum or a temple. Excavation may not be easy, for on one side of the site there is a row of buildings, and beyond them the main road, although on the other side there is a large open space on which, last summer, a number of nomads had pitched their *yurts*. But this lucky find disproves the conclusion drawn from M. Foucher's unsuccessful excavations at Balkh, namely that the hellenistic cities of Bactria, like their successors of to-day, were all built of mud or sun-dried brick, and had therefore left no trace behind.[1]

Somewhere, perhaps underneath the shapeless mounds round Balkh, many of which are the mud of which later cities were built, there must be other Greek structural remains of stone. Chang K'ien found (128 B.C.) Bactria to be a land of walled towns,[2] and in Ferghana, the Greek occupation of which was until recently in doubt, he speaks of "fully 70." The difficulty is where to begin looking for them. Classical writers only supply with certainty two names of cities in Bactria and two in Sogdiana, and a Sanskrit source perhaps adds a fifth; and of these five the position of two is uncertain,[3] and only Balkh lies within the boundaries of modern Afghanistan. Dr. Tarn may be right in saying that most of the towns seen by the Chinese were military colonies or large villages walled with mud. But chance has brought one lucky find, and may add others. Excavation at Kunduz may at least show what a Bactrian town of which there is no mention in classical writers was like.

Some 2 miles north of the place where these remains were found, there is

[1] M. Foucher has not yet published a detailed report of his excavations at Balkh, where he laboured with a large army of workmen for eighteen months (1923–25). His general conclusions will be found in his 'Étude sur l'art bouddhique de l'Inde' (Tokyo, Maison Franco-Japonaise), pp. 57–62. He told the Congress of Orientalists at Oxford that in the "Mother of cities" he had found "absolutely nothing."

[2] F. Hirth, "Translation of the Shi-ki of Ssu-ma Ch'ien" (*J. Amer. orient. Soc.* 37 (1917) 89ff.).

[3] Summary of the evidence in Tarn, *op. cit.*, p. 118.

a huge "castle" with walls of mud 100 feet high and over 2 miles in circumference. There is a wide and deep moat, and there are four gateways. The interior consists of a series of shallow undulations or mounds well rounded by the weather, which indicate the remains of mud buildings, aligned along two roads which intersect at the centre and which connect the four gates. The fortifications on top of the enceinte are obviously comparatively modern; they still retain the shape of walls. But because here, too, builders had been excavating earth, we were able to examine some of the lower strata of kiln-baked brick. These lower walls were very reminiscent of Sassanian building, and some of the pottery collected from these levels proves to be similar to pre-islamic Persian types which, thanks to the labours of Mr. Pope, we can now arrange in some sort of chronological order. In appearance, this impressive ruin is very similar to the Parthian fortress of Takht-i-Suleiman, which Mr. Pope has recently surveyed on the western marches of the Sassanid Empire.[1] From Kunduz a road, along which I was not permitted to travel, runs to the Oxus, and close to where the Kunduz river joins the Oxus there is a ruined fortress which, though apparently smaller, was described to me as of similar plan. It is called Kalat-i-Zal, a name so often associated with pre-islamic remains. The ruin at Kunduz is a site of which we cannot say anything more definite at present than that it should be excavated. But I think that it will almost certainly prove to be one of the strongholds by which the Sassanid kings maintained a shaky hold on the Bactrian frontier, and Kalat-i-Zal may have been an outlying post commanding the passage across the Oxus.

There is a third site at Kunduz, a mile and a half north-east of the town, and about a mile from the fortress, which until two years ago might have attracted no more attention than the other mounds dotted over the surrounding country. During the autumn of 1936 excavations made for an irrigation canal brought to light a number of fragments of rather mutilated stucco figures, which were sent to Kabul. The local officials dug into the mound and, without finding any more fragments of importance, they uncovered three chambers with apses in the mud walls. M. Hackin paid a brief visit to the site a few months later, when the countryside was unfortunately covered with snow, and he was easily able to recognize the remains of a Buddhist monastery, no doubt one of the ten the existence of which Hiuen Tsiang records in the Kunduz region.[2] From the shape of the mound there would appear to be two courtyards surrounded with cells, and the large lump at the northern end probably represents a stupa. M. Hackin has published an account of the stucco fragments in a pamphlet printed in Kabul.[3]

Chance has here provided what may prove to be a find of first-class importance, for these seven heads are the first Buddhist sculpture from the regions north of the Hindu Kush. It would delay me too long if I mentioned here more than one or two of the possible or probable implications of this discovery. It has always been supposed that the Buddha image, missing on all

[1] Preliminary report in *The Times*, 18 February 1938, and in the *Illustrated London News*, 26 February 1938.

[2] Beal, 'Records of the Western World,' p. 288.

[3] 'L'art bouddhique de la Bactriane,' 1937.

early Buddhist monuments in India where the Master is represented by his footsteps or some other sign, was created somewhere in northern India, either at Mathura or in Gandhara, and that it was the work of "Greek refugees," or "Indians," or "Indianized Greeks." Buddhism of course reached Bactria from India, and the hitherto non-existent Buddhist art of Bactria was assumed to have been a derivative of Indian models, like that of Hadda, or of the Tarim basin. But these heads from Kunduz are in some ways more "Greek" than any Buddhist sculpture in India, and they show, in more primitive form, some of the conventions developed in Gandhara. If M. Hackin is right in dating them in the first century B.C. or the first century A.D., it will follow that the Buddhist art of Bactria was an independent development, and that the Buddha image was created there and not in India. The historical probability is that Buddhism reached Bactria very early, before Buddha was personified in stone or plaster. The Bactrian Buddha may have gone to India, where, in an Indian environment, he may have become the Buddha we know so well in Gandhara or at Mathura. As a working hypothesis, M. Hackin's dating is the only one that will make sense, for, if some of these heads look more Central Asian than Greek, they are certainly not importations from India.

From Khanabad we took a new road, only completed last summer, to Faizabad, a distance of 137 miles. The making of roads is one of the chief concerns of energetic Afghan governors, and this road came into being without the assistance of any European engineer or even that of a steam-roller. Beyond Kishim, where it leaves the old caravan track which ran *via* Daraim to Faizabad, the road cuts its way through the gorges of the Kokcha, parts of which were hitherto impassable. Workmen had to be suspended in baskets from the almost perpendicular cliffs to drill the holes for blasting. The men of each village are made responsible for completing the section of the road in their district, and above Faizabad, where the road is now being traced to Jurm, we saw the Governor in his shirt sleeves directing his men. The bridges are made of logs covered with rubble, and they have to be renewed twice a year, for each seasonal migration of the nomads' sheep destroys them beyond repair. There is not much traffic yet, only a motor lorry once every two or three weeks. Even in the neighbourhood of Khanabad horses panic at the first sound of a motor vehicle, and it took as much as half an hour to get through a large flock of sheep. Petrol for the return journey had to be taken from Faizabad, and in the back of the car we had to crouch between a petrol tank and the roof.

At Faizabad we were the guests of the Governor, whose province of Badakhshan includes Wakhan and stretches up to the Chinese frontier on the Wakhjir pass. Our host had some sad stories to tell of American and German travellers who had reached Faizabad in the belief that instructions had been given for them to proceed into Wakhan, and whom he had had to turn back. But after some telephone conversation with the Governor-General in Khanabad, who had given us a most cordial reception, we received permission to proceed on horseback to Jurm. In doing so we were, I believe, the first Englishmen to pass that way beyond Faizabad since last century, perhaps since Lockhart and Woodthorpe reached Ishkashim in 1886. Seven horses were hired, through the good offices of the Governor; two of these were for baggage, and

the rest for ourselves and our military escort, it being understood that the three Tajik caravan drivers were to walk. But these Badakhshan horses are so sturdy (their fame reached the Chinese Emperor at an early date) that for long marches two of the drivers would ride on top of the baggage on one horse.

The whole of the north of Afghanistan is frankly marked as "unsurveyed" on the Survey of India map, except where it shows the results of the two boundary commissions, on the west and in the High Pamirs, and in the far eastern corner, which has also been sighted by the theodolite of Professor Mason. It was therefore not surprising to find that the shape of the Kokcha valley on our map was incorrect, and that Faizabad, for instance, was perhaps 20 miles out of position. For this part of the map presumably goes back to Wood's journey, and to the traverses of those remarkable surveyors Pandit Manphul, who came to Faizabad in 1867, and the Munshi, Faiz Bakhsh, who went to Wakhan in connection with Forsyth's Yarkand expedition in 1870. These reports were summarized by Colonel Yule in "Papers connected with the Upper Oxus regions" (*Journal R.G.S.* 42 (1872) 438ff.).

But our chief concern was with ancient geography. We were on the first stage of the route which goes up Wakhan to the headwaters of the Oxus and crosses the Pamirs to Tashkurghan and the Tarim basin, followed by Hiuen Tsiang on his homeward journey, by Marco Polo, and by the Jesuit, Benedict Goes, in the seventeenth century. It has been repeatedly stated by Sir Aurel Stein that this branch of the Silk Route was of much less importance than the one which ran from Termez on the Oxus up the valley of the Waksh, through the broad valley between the Alai and the Trans-Alai, and past Irkistam, the present frontier station, down to Kashgar.[1] This theory goes back to Yule's [2] and Richthofen's [3] reading of Ptolemy,[4] and after securing the weight of Dr. Herrmann's authority[5] it has since been endlessly and uncritically repeated as if it were an historical fact. It is of course true that the Alai valley is a "natural highway," and Sir Aurel Stein's explorations have proved that this is the route which Ptolemy appears to describe, even if we may never know the exact position of the "Stone Tower." But to say that Ptolemy refers to the Alai valley is one thing; to argue from such premises that the main trade route passed that way for many centuries is quite another. Ptolemy's geography of the regions beyond the Pamirs is so confused that it is hard to make sense of it. His information, obtained at fourth hand and apparently from a single expedition of merchants, hardly provides a suitable basis for generalizations about the whole of ancient and medieval trade.

There are a number of reasons for thinking that the Wakhan route may have been nearly as important as the northern route, and in discussing them it must be remembered that this is not only, or even primarily, a question as to which way the silk came to Persia and the Mediterranean; we want to know how, in the reverse direction, Buddhism went from India to

[1] *Geogr. J.* 65 (1925) 381; 'Ancient Khotan,' I, pp. 54ff.; 'Innermost Asia,' II, pp. 847ff.; "On ancient tracks past the Pamirs," *Himalayan J.* 55 (1932) 21–4.

[2] H. Yule, 'Cathay' (2nd ed. by Cordier, 1915), I, pp. 190ff.

[3] Richthofen, 'China,' I, pp. 497ff.

[4] Ptolemy, *Geog.* I, xii.

[5] A. Herrmann, 'Die alten Seidenstrassen zwischen China und Syrien,' (1910) map; 'Das Land der Seide und Tibet im lichte der Antike' (1938), pp. 105ff.

China, how the plaster sculpture of Hadda got to Khotan. To begin with I think that we can definitely exclude the passes over the Karakoram as a route along which Buddhist civilization may have travelled. So far as I am aware, there is no evidence that the Karakoram pass was used in ancient times, and Fa Hien's account of the Gilgit road reads like a piece of exploration. But more decisive than negative evidence is the fact that the archaeology of Kashmir is provincial; it is a local derivative from Gandhara, and not an intermediate stage between Gandharan or Hadda prototypes and the Buddhist art of the Tarim basin. The route up the Kunar valley and over the easy Baroghil pass to the headwaters of the Oxus, which Sir Aurel Stein followed on his second Central Asian expedition,[1] might be considered, but two wrecked stupas at Gilgit and a rock carving at Mastuj are not much evidence. Had this been a main road, for trade or pilgrims, something more substantial would have come to light at Chitral during forty years' occupation by British troops.

It seems clear that the main route from India and the Kabul valley to the Tarim basin lay across the Pamirs. Now Wakhan was much nearer the Khyber than the Alai route which ended at Termez, for it could be reached through the valleys of Kafiristan, many of which are still unexplored. A caravan driver assured me that a good horseman could ride from Jurm to Kabul, *via* the Anjuman and the Nawak pass, in three days. There is still much traffic on this route. For a caravan coming from China round the southern rim of the Tarim basin, Wakhan is the shortest route from Khotan to Bactria or India. The northern oases of the Tarim basin were frequently subject to raids and temporary occupation by invaders from the Dzungarian steppe, and again Kashgar was naturally and easily occupied by invaders from Ferghana, as it was by the Turks. To such general historical and geographical considerations we may add the fact that in the seventh century Wakhan was for a time a Chinese administrative district. But the archaeological evidence is of much greater weight. The fruits of Sir Aurel Stein's reconnaissance in the Alai valley were some old cultivation terraces, a mound or two and the remains of a few stone buildings.[2] Wakhan, on the other hand, is known to be full of fortifications, buildings, and caves, which Sir Aurel Stein believed to be of Sassanid date, and among which he has also found traces of Buddhist worship.[3] No site in Wakhan has yet been excavated, and in a sense it has never been explored. The route through Wakhan has always followed the southern bank of the Oxus, for the floor of the valley is broader there, and the chief settlements mostly lie on the south (or Afghan) side. Sir Aurel Stein and Olufsen[4] have explored the Russian bank, but, so far as I am aware, no record exists of any traveller who has been on the Afghan side of lower Wakhan since Wood made his famous journey to the sources of the Oxus in midwinter exactly a hundred years ago.[5]

[1] 'Serindia,' I, pp. 30–72; *J.R. Asiat. Soc.* 1910, p. 37.

[2] 'Innermost Asia,' II, p. 847.

[3] *Ibid.*, pp. 863–76.

[4] F. Olufsen, 'Through the unknown Pamirs,' 1904.

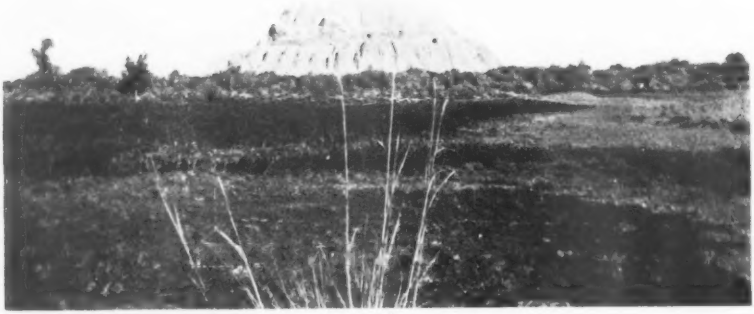
[5] Sir Aurel Stein crossed the Baroghil saddle and surveyed the uppermost part of the valley from Sahrad to the Wakhjir pass ('Serindia,' I, pp. 60ff.). Colonel T. E. Gordon visited the part of the valley between Kila Panja and the Little Pamir lake ('Roof of the world,' 1876).

The Warduj valley from Baharak looking towards the Pamirs

Bridge over the Kokcha at Faizabad

The plain of Baharak from the south-east

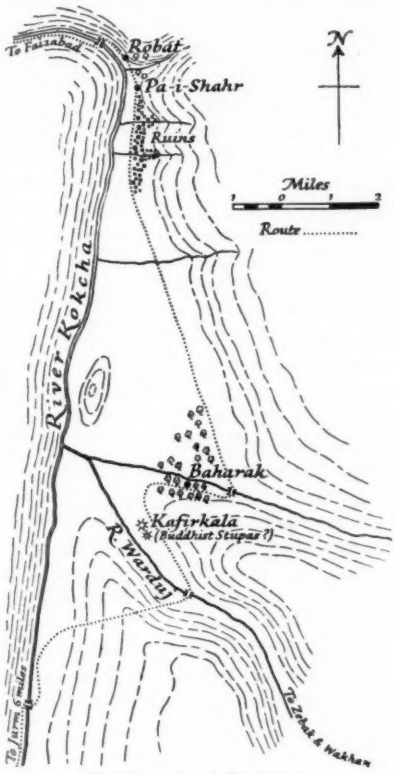
Ruined building in Balkh



The great Buddhist stupa at Balkh

The walls of Balkh

Thorough excavation of some of the ancient sites in Wakhan must be perhaps the most important single item on any agenda of archaeological work in Central Asia, and there is every hope that the progressive and liberal spirit that animates the present Afghan Government will allow it to be done. On our journey up the Kokcha, we made a discovery which strengthened my conviction that the Wakhan was an extremely important route. For about 15 miles beyond Faizabad the Kokcha runs in a series of narrow gorges. The valley then broadens out to the width of a mile, although for some way farther upstream the river is in a trough and cannot be used for irrigation. Beyond a hamlet with the significant name of Pa-i-Shahr ("foot of the town"), we came across remains of undressed stone, strewn along the valley for a distance of about 2 miles. It was not always easy to trace the exact extent of the ancient site, and only here and there, chiefly in the entrances to the side valleys, was it possible to make out the plan of the buildings with any certainty. For the stones had frequently been cleared away and built into walls supporting recent terraced cultivation, and occasionally they had been piled up to make sheep enclosures. But there can be no doubt that this is the site of a large city, almost certainly that of the ancient capital of Badakhshan. Judging from a map, it lies exactly where one would expect to find it.



Sketch-map of Baharak

Just beyond the end of these remains the valley opens out into a fertile plain, triangular in shape and some 6 miles by 4 miles at its greatest extent. Here the Kokcha receives two affluents, the Warduj, from the south-east, which the route to Wakhan follows as far as Zebak, and another from the east. The village hidden by luxurious fruit trees on the farther edge of the plain, at the entrance to the Warduj valley, is called Baharak, a name long associated with the ancient capital. "Khairabad," placed at this point on our modern maps, and to which they attribute a post office, has disappeared, both as a place and as a name. Farther on, in the mouth of the Warduj valley, at the spot where the traveller coming from the east might feel that he had at last emerged from the Tsungling mountains, are two mounds of roughly

hewn stones, which have the appearance of wrecked stupas. They are known locally as *Kafirkalas*, although the nearer we get to modern Kafiristan, the greater the caution necessary in attributing importance to this name. The plain of Baharak itself would have been an unsuitable site for a city. Its extreme fertility would have been wasted, and again it could have been attacked from four sides. The town built in the narrow valley just off the plain commands the route leading from Faizabad to the Warduj and Wakhan, and the extent of the ruins illustrate, I think, the importance of that route, to which I have already referred. Holdich [1] discussed the position of Idrisi's city of "Badakhshan" at length, and finally came to the conclusion that it was more likely to have been Jurm than Faizabad. Neither of these places could have supported a large population, for they are situated on narrow rocky shelves, between the river running in a gorge and the steep sides of the valley, and corn would also have had to have been brought from a distance.

The days we spent riding through the uplands of Badakhshan, close under the Roof of the World, with distant views of glimmering white summits, were among the pleasantest of our travels. Our camp was supplied with the famous fruits of Badakhshan; indeed, apples of Baharak are sent all the way to Kabul, where they fetch a fabulous price in winter. We found nothing else of antiquarian interest, except two or three Greek and Sassanid coins in the bazaars of Faizabad and Jurm. Unfortunately we did not have permission to leave the main route, part of which, where it follows the Kokcha below Faizabad, does not follow any ancient highway. A thorough archaeological exploration of Badakhshan north of the Kokcha and of the Anjuman south of Jurm should produce interesting results; it is strange to think how little, if at all, our knowledge has advanced since, by the study of place-names, by combing the works of the Arab geographers, and by using reports now lost or buried in the archives in Delhi, Sir Henry Rawlinson collected so many indications of ancient sites in this region.[2]

From Faizabad we returned to Khanabad, and although it was only the beginning of September, Shiva lake was said to be frozen and nomads were already on the move, streaming down the valleys to lower pastures on the plains. After a visit to Kunduz, to see whether our friends the builders had done any more excavation, we crossed the plain to Balkh. On the way we had a distant view of the Oxus, across a belt of desert, with the mountains of Russian Turkistan beyond. Balkh is a wilderness of mud walls of uncertain age, 11 miles beyond the modern provincial capital of Mazar-i-Sharif, which has grown up round the chief shrine in Afghanistan, a splendid building of the Timurid epoch. M. Foucher found that the stupa, 200 feet high, described with such a wealth of detail by Hiuen Tsiang, had become simply a huge cake of mud. The walls of Balkh are 7 miles in circumference. It is idle for us to hazard an opinion as to whether, if M. Foucher had dug deeper or at some other spot in that great area covered by walls, mounds and rubbish heaps, he

[1] Sir Thomas Holdich, 'The gates of India,' pp. 273–4 (1910). Holdich did not notice that Idrisi was uncritically repeating Ibn Haukel's itineraries, with a few inaccurate interpolations which are the source of much of the confusion in his itineraries. 'Idrisi' (ed. Jaubert), I, pp. 474–5 = 'Ibn Haukel' (ed. Ouseley), pp. 230–31.

[2] H. Rawlinson, "A monograph on the Oxus," *Journal R.G.S.* 42 (1872) esp. 507ff.

might not have found something more substantial under the mud of successive ages. Greek coins are certainly numerous in the bazaars of Balkh, and indeed, until six or seven years ago, when the Afghan Government introduced its first paper currency, they were often common tender.

On the plain between Balkh and Shibarghan, some 50 miles west of Balkh, we examined and plotted on the map a very large number of mounds, from about half of which we were able to bring back an assortment of pottery fragments. Most of these sherds are variants of those slip-painted and splash-glazed wares which we call early Islamic, but which we cannot easily classify. Chronological argument is defeated, not, as in India, by the conservatism of the potter, but by the inadequacy of our knowledge and of comparative material. This is not the place to give a detailed account of these mounds, of their shapes, dimensions, and distribution. They are mostly found in groups, for the larger tumuli have a number of small dependencies. By relating this topographical data to the pottery, when it has been examined, I hope that we shall at least be able to decide which type of mound has the semblance of antiquity and would therefore warrant excavation.

A number of systems of ancient irrigation canals can be traced on the plain, a detailed survey of which would be a necessary adjunct to any programme of systematic excavation in Bactria. What I may call the classical view, elaborated by Holdich,[1] is that these canals were fed by the Oxus. But this is contradicted by Idrisi,[2] who says that the Oxus was not used at all for irrigation until it reached a place certainly situated below the modern Russo-Afghan border. Idrisi was merely repeating what Ibn Haukel said in the tenth century.[3] It is difficult to believe that the Greeks were more enterprising in this respect than the Turks and Arabs were before Genghis Khan left his mark on the civilization of Bactria, or that, if they were, the Arabs would not have known of such an ancient irrigation scheme and turned their knowledge to some account. There is, on the contrary, some evidence that the Balkh river once reached the Oxus, and I must leave the explanation of the desiccation of Bactria to climatologists, or to those geographers who are familiar with the hydrography of the Hindu Kush.

At the end of September we were back in Kabul as the grateful guests of Sir Kerr and Lady Fraser-Tytler, and in Peshawar we rejoined the two members of our party who had been excavating in Swat. We had travelled over 2000 miles in Afghanistan, a stern but hospitable country of rugged mountains and wind-swept plains. The archaeology of Central Asia is still a thing of shreds and patches, and if there is perhaps too much of the dust of history in what I have told you of our researches, I hope that I may have been able to interest you in some of the problems which may be solved by future expeditions to Central Asia.

[1] 'Gates of India,' p. 75.
[2] Ed. Jaubert, I, p. 475.
[3] Ed. Ouseley, p. 239.

DISCUSSION

Before the paper the Chairman (Professor KENNETH MASON) said: To-night we are to listen to a paper by Mr. Evert Barger, Lecturer in Medieval History at the University of Bristol, who has been out in Afghanistan working on the old culture-routes of those parts. The subject is one which has not been before us since Sir Aurel Stein completed his pioneer work something like twenty-five years ago. It is a subject which Mr. Barger has, through his own initiative and energy, managed to revive and bring to a new stage of development.

Mr. Barger then read the paper printed above and a discussion followed.

The CHAIRMAN: Mr. Philip Wright, of the Indian Section of the Victoria and Albert Museum, was a member of the expedition and was in particular responsible for the latter part of the work in Swat. I will ask him to add a few words.

Mr. PHILIP WRIGHT: From what Barger said with regard to the interrelations of Greco-Buddhist art of the Gandhara district (that is, roughly the Indian frontier district), the plaster sculptures of Hadda in southern Afghanistan, and the Buddhist art of the Central Asian routes to China, it will be clear that, although the two parties into which the expedition divided were separated by some hundred miles of mountainous country, they were both working on different aspects of the same problem. The immediate objectives in Swat were somewhat different from those in Afghanistan as were also the methods, because the kind of preliminary survey which Barger and Emanuel were making in northern Afghanistan last summer had been done in Swat by Sir Aurel Stein over ten years ago. Sir Aurel was not given permission to excavate in Swat and no archaeologist had ever been allowed to dig there until in 1938, largely owing to Barger's pertinacity and persuasiveness, we obtained permission to carry the archaeological exploration of Swat a step further. I should like to say that once we were in the country the North-West Frontier Government, through their representative, the Political Agent at Malakand, and the Ruler of Swat himself, did everything to help us, and were extremely kind to us.

It had been known for a long time that Swat was very rich in Buddhist remains. The Chinese pilgrim Hiuen Tsiang, who travelled that way early in the seventh century, described Swat as having at one time had as many as 1400 monasteries. That may have been a pious exaggeration, but certainly there is an enormous wealth of ruins there. One of our chief objectives was to get together a collection of sculptures from monasteries which would be fairly representative of the art of this corner of the Gandhara district, a collection which would be better documented, at any rate, than the great majority of the Gandhara sculptures which have turned up in the bazaars in Peshawar and elsewhere with any label that the dealers cared to give them. No one knew where they had come from or in what circumstances they had been dug up.

We spent the first six or seven weeks excavating various monasteries, nearly all within a few miles of Barikot, which is about 20 miles up the valley. We chose that place because it is at present a flourishing village, at a meeting-point of three side valleys with the main valley, and all these side valleys are crowded with ruins. There are many more ruins in the side valleys than on the floor of the Swat valley itself, perhaps partly because the big Swat valley is too swampy —there is very little margin of firm ground—and also because all the more accessible sites have been pillaged, largely by villagers for stone for their houses. It was only the more inaccessible sites that really gave us a rich collection of sculpture. Consequently, we found ourselves camping in caves about 4000 or

5000 feet up or spending three or four hours a day wading across the river to sites on the less-frequented farther bank.

We were not entirely preoccupied with monasteries as such; we wanted to get a more general picture of the lay-out of the country in Buddhist times. As the basis for that picture Weatherhead, the surveyor, made a comprehensive map of all the ruins of that period in the valley, not only of monasteries and shrines, but forts, villages, cultivation terraces, ancient waterworks, barrages, and so on.

In the last month or so we travelled farther up the valley and spent some time in the excavation of quite a different kind of site: a large flat-topped mound near Charbagh, about 25 miles up the Swat from Barikot, our first headquarters. Sir Aurel Stein saw that mound and described it as an acropolis. That may be correct; at any rate it was certainly a centre of habitation. We found on the lower slopes of the mound the ruins of Buddhist walls and pottery indicating occupation of the site in Buddhist times and probably for some centuries later, and beside the pottery we found a certain amount of iron-work, a few heads, terra-cotta figures and a few very battered pieces of the same kind of sculpture as decorated the monasteries. Not perhaps very much to go on, but I think it was enough to encourage one to go on excavating that kind of site. There are plenty of sites in the Gandhara plain which must conceal ancient villages and which so far have been practically neglected by archaeologists. It is the excavation of these rather than future exploration of monastery sites that may help us to fill in details of our very incomplete picture of Buddhist civilization in that area.

Mr. W. V. EMANUEL: I was not expecting to say anything, but perhaps I might add a few personal touches about our methods of living and working, which may be of interest to non-technical members of the audience.

In particular, it may interest you to know how we lived. The food in the Swat valley is limited. It consists mostly of rice, for the valley is covered with rice fields, but rice perpetually is not a very good diet for Europeans. We lived largely on chickens which, like the rest of the inhabitants of Swat, are rather poor; and on kidneys. Apart from chicken we had a few vegetables such as tomatoes and marrows. There are more vegetables than one would suspect in that very poverty-stricken country: the valleys in between those wind-swept and barren mountains are surprisingly rich and fairly well cultivated. We occasionally got fruit from India. In Afghanistan we were saved by having an old servant with us because, although he was not hired as a cook, he was able to produce from the bazaars in a very short time, with the aid of three bricks and two or three pots, a very good meal which was free of *ghee*, the frightful clarified butter or mutton fat with which the Afghans cover all their dishes. They have very few different dishes and they all taste of the fat. When we stayed with governors and in rest-houses we had to do as the Romans did. We also had some very tough mutton, and our greatest fear was of some kind of dental trouble in a country of no dentists.

Mr. Barger has already mentioned our methods of inquiry. It is difficult to convey to you the fascination and interest of wandering round a bazaar and really getting to know how to go, shall we say, from the Street of the Potters to the Alley of the Hat Makers. After going round two or three mornings one soon gets to know which merchant has a particular cache of Greek coins and how many *Afghanis* he is going to go on asking until he reaches the price one is willing to pay for the coin. There are surprises, such as mysterious English coins, 1837 pence, and coins of Peter the Great which turn up among the Sassanid seals and the coins of Bactrian kings. There is something extra-

ordinarily and uniquely fascinating about the chase for the past in a country which in the present is so interesting because it is so unspoiled.

Mr. JOHN DE LA VALETTE: It is a terrible admission for one so long a Fellow of this Society, but I must confess that I cannot add to the geographical side of the subject under discussion. There are however certain other aspects about which I might say a few words.

We must, I think, all admire Mr. Barger and his comrades for having selected the months of July to September in which to carry out their work; they must have been terrifically hot months. It shows not only that they had all the vigour of youth, but that they had all the enthusiasm which makes real archaeologists. Perhaps too this is the moment to say that it is about time that something should be done in those regions by Englishmen in the way of archaeological research for, as you have heard, nothing very much has been done there by the English for twenty-five years. There may be political reasons for that. Men like Mr. Barger and his colleagues are however the best political agents. It is all very well to say, as Mr. Barger did, that when you get into a country things suddenly become easier; that depends on the man who gets into the country, and his behaviour when there.

One point which immediately emerges from this discussion is that, whatever may be the outcome of the careful scrutiny of the objects brought back by the expedition, they only represent a first step. Even so they will probably provide a great deal of evidence to complete our scrappy knowledge of the chronology of that part of the world and of the interrelations between the arts of India, China, Greece, Persia, and Turkistan in this particular part of Afghanistan where so many trade routes meet.

Mr. Barger's expedition was made possible partly by the assistance of the Royal Geographical Society, as he mentioned, and also by the support given to him by the authorities of the Victoria and Albert Museum who are responsible for the Indian Section. This is a remarkable achievement, because I believe it is the first time that the Victoria and Albert Museum have considered it within their province to support an archaeological expedition, as they did by lending the services of Mr. Wright and in other ways. I feel sure that if with this support and the support also of the India Office and the Indian authorities on the spot the expedition can be repeated, the preliminary work which has been done so brilliantly this time will lead to very important finds. I am very glad to think that the men who have been engaged on this expedition are all so young that they have still a long time of fruitful research before them. They may thus help to advance not only archaeology and geography but also the good repute of England in a part of the world where it may well need a little more moral support.

[*The following contribution has been received by the Editor.*]

Mr. K. DE B. CODRINGTON: I am glad to take this opportunity of congratulating Mr. Barger and the members of the expedition on the work they have done. The discovery of the Kunduz pillars is obviously of the greatest importance, while the list of sites reported holds great promise for the future.

It seems to me worth remembering that the problem of Bactria, that is to say of hellenism in the East, is not the only problem. The ewers and vases which are to be seen everywhere on the Ajanta frescoes are Sassanian in form. The costume, or rather uniform, of the retainers in many of the frescoes is a close parallel to the costume of the Bamiyan frescoes, and both derive from somewhere west of India. The pottery fragments which Mr. Barger has brought back from some of his sites contain Sassanian types as well as Islamic types.

It should therefore be clearly possible to reconstruct the history of the Oxus valley after the hellenistic period.

The difficulty of hellenistic archaeology is largely one of defining provincialism. Not only do the areas concerned tend to be vague, because of the lack of governmental and social traditions, but the cultural forms tend to be preserved over long periods. They do not change as they do in the great centres where wealth and fashion rule. For instance, turning to the region south of the Pamirs, we know that the Greco-Buddhist art of Gandhara was in existence in Kanishka's reign: it is reflected in his famous relic-casket and in certain Buddha figures from Mathura. We also know that in its moulded plaster form, typified by the Hadda finds, it persisted well into the fifth century A.D. and later. Yet the types seem to show almost no trace of organic development during these four centuries or more. Indeed, though we know from extant texts and from the reports of the Chinese pilgrims, who were on the spot, that sectarian Buddhism existed, we are still unable to distinguish from the architectural and sculptural remains, including the iconography, which sites were Hinayana and which Mahayana. In other words, we do not know the Buddhist tin tabernacles from the Buddhist cathedrals.

Mr. Barger's greatest contribution is the picture of the human conditions he has given us. Further excavation will doubtless help to reconstruct, in some sense at any rate, the cultural possibilities of Indians living in Afghanistan and Greeks in Bactria. Controversy based on largely unedited literary accounts can only lead to a clash of opinions. It is only too obvious that the various trends of opinion are contradictory. The decision lies with the spade.

The CHAIRMAN: I would like to ask your permission to quit the Chair for a few moments in order to say a few words on this extremely interesting subject. Mr. Barger will have, before I return to the Chair, the opportunity of shooting me dead if he feels so inclined.

The lecturer has, in the course of his most interesting paper, mentioned the Munshi, one of the Survey of India explorers, who went with Forsyth's Mission to Yarkand in 1870. Perhaps as one who has surveyed on the Pamirs I may be permitted to add a few words with regard to these men. While the exploits of the Hindu Pundits, A. K., Nain Singh, and the rest of them who explored Tibet, are now pretty well known, the services of the no less intrepid Mussulman explorers of the North-West Frontier have been less generally recognized. Perhaps the four most conspicuous of them were those known as "the Mirza," "the Mullah," "the Havildar," and "the Munshi."

The Mirza, between 1868 and 1873, made important journeys across the Pamirs and was eventually murdered while asleep near Bukhara. The Mullah, between 1873 and 1879, explored Dir, Swat, Chitral, and Mastuj, and passed on to Yarkand, besides tracing the whole course of the Indus from the plains to Bunji. The Havildar, between 1870 and 1874, made three important journeys to Bukhara, visiting Faizabad and Kulab, and reaching Yazghulam on the Oxus, between Darwaz and Roshan. And the Munshi, among other travels, followed the Oxus through Wakhan for 60 miles to its great northward bend at Iskashim and then followed the river northwards through the then totally unknown districts of Shughnan and Roshan to Kala Wamar, near the confluence of the Murghab and Oxus.

The work of these men was beset with extraordinary difficulties and dangers, and if their maps do not reach the requirements of modern archaeological research we must not be surprised. The accurate mapping of these distant regions is a progressive operation which takes many years to complete. I mention these facts because there may be a misconception in Mr. Barger's mind.

The word "unsurveyed" on a map is not identical with the word "unexplored." These old Mussulman travellers were explorers of routes; their observations and reports were collated and compiled; succeeding travellers have used their maps and added to our knowledge, and the work of surveyors has been made vastly easier on their account. The archaeologist now has an easier task than the archaeologist in the past. At the same time, an absolutely accurate topographical map is not essential for the correct interpretation of an outline of historical fact, and it would be wrong to assume that scholars of a past generation must necessarily fall into error because they had not such maps.

There is another comment I wish to make. Mr. Barger remarked that Sir Aurel Stein had repeatedly stated that the northern route by Kashgar, Irkishtam, and the Alai valley was of "much more importance" than the two routes by Shughnan and Wakhan; and he said: "This theory goes back to Yule's and Richthofen's reading of Ptolemy, and after securing the weight of Dr. Herrmann's authority, it has since been endlessly and uncritically repeated as if it were an historical fact." Now I do not pretend to be an archaeologist, and I presume that archaeologists have their own little differences of opinion, just as geographers and surveyors have. But I have studied the geography of those regions very carefully and I have read and studied most of Sir Aurel Stein's writings year by year as his expeditions took place: those three remarkable journeys of detailed geographical and archaeological exploration in Central Asia. Perhaps in Sir Aurel Stein's absence I may be permitted to make some brief observations.

Firstly, when Sir Aurel Stein was stressing the importance of the northern route he was, I am quite sure, alluding to the Silk Route from China westwards, and not to the Culture Route from Gandhara to Central Asia. These are two very different questions. To begin with, their termini are by no means identical; while, if we are to accept Mr. Barger's chronology, the Silk Route must surely have been in use long before the Culture Route. As a fact of geography, which cannot be denied, the northern route is considerably the easiest of the three, owing to the difficulty of getting off the Pamirs from the two southern routes, and therefore the northern route would be the more natural route, geographically, between Mesopotamia and China, especially in times of political security. On the other hand, Gandharan culture would more naturally follow the direct southern route. It should be remembered that, though Sir Aurel Stein may not have had the good fortune to explore the Oxus and its tributaries in Badakhshan, he has closely examined in detail those sections of all three routes which cross the Pamirs, which Mr. Barger has not; and Sir Aurel has, in fact, written as much about the southern route as the northern. It is relevant here to stress the fact that these three routes across the Pamirs have no direct bearing on those north and south of the Taklamakan desert farther east: it is quite possible for the old Silk Route to have gone through Khotan, Yarkand, Kashgar, and by the Alai valley while the Gandhara culture route may have passed through Wakhan, the Little Pamir, Tashkurghan, and Kashgar to Turfan, the two crossing at either Yarkand or Kashgar.

My second point is this: If Ptolemy's geography of the regions beyond the Pamirs is so difficult to follow, is it not remarkable that four such scholars as Baron Richthofen, Sir Henry Yule, Dr. Herrmann, and Sir Aurel Stein—none of them particularly anxious to take each other's opinions without a certain amount of scrutiny and all with such varied experience in travel and learning—should agree on the route followed by the agents of the Mesopotamian Maës along the northern Silk Route in the first century A.D.? The same scholars are agreed that

the Buddhist pilgrims, Sung Yün and Hui Sheng in A.D. 519 and Hiuen Tsiang in A.D., 642 followed the southern route through Wakhan. Sir Aurel Stein expressly quotes Hiuen Tsiang as having heard an old story that a great troop of merchants, with thousands of followers and camels, had once perished by wind and snow near the Chichiklik hospice on the southern route. There is indeed little doubt that both routes were in use for the silk trade. Possibly one was used more than another at one time or other. Balkh would have surely lain on both.

Sir Aurel Stein is the last man to generalize the history of centuries from an isolated classical allusion. He digs deep for his facts. And if his views have been misinterpreted in this respect, as undoubtedly they have been misrepresented in the problem of desiccation in Central Asia, I can assure you that the fault is not his. I am not saying that Mr. Barger has misrepresented Sir Aurel's views, but perhaps he is a little inclined to accept another's misrepresentation. At any rate, those are my views, and now Mr. Barger may, if he desires, shoot me dead.

Before sitting down I would like to express our deep appreciation of all the help that both the India Office and the French authorities have given this expedition. I hope that all that can be done will be done in order to further the exploration of the region. Intensive work has hardly yet begun in Central Asia. We have now to dig deep.

Mr. EVERT BARGER: So far from my having any desire to shoot the Chairman dead, I think we are all of us to be congratulated that my few remarks on the historical geography of the Pamir region should have drawn such a valuable contribution to this discussion. If I still hesitate to accept some of Sir Aurel Stein's views on the fascinating problems of the Silk Route, and if I have not been altogether persuaded by the impressive arguments to which we have just listened, that may only be because I am rather obstinate. It would be presumption on my part if I attempted to challenge the Chairman's authority or that of Sir Aurel Stein on any question affecting the geography of the Pamirs. In replying to what the Chairman has said, I confine myself, as I tried to do in my paper, to the historical evidence (some of which is of course supplied by the archaeologist), and to the methods of synthesis and ways of thought appropriate to the historian.

Let me begin by saying that the distinction which the Chairman has drawn between the Culture Route, from the Indian frontier (Gandhara) to China, and the Silk Route, from China to the West, seems to me a very penetrating suggestion. But I am uncertain how far this distinction would carry us in solving the main problem, which is that of the relative importance of the two routes during a period which lasted a thousand years. The Chairman was certainly right in pointing out that the chronology which I inferred from the archaeological evidence supposes the existence of the Silk Route described by Ptolemy some centuries before Buddhism travelled from India to China along the Culture Route. But we know from the Byzantine sources that silk caravans were still coming overland from China during the period (say from the fourth to the ninth century) in which Buddhist missionaries such as Hiuen Tsiang were crossing the Pamirs, and Wakhan was even for a time a Chinese province. Those centuries are perhaps the crucial period in the march of civilizations across Asia, as I think the archaeology of the Tarim basin shows. I find it hard to believe that during that period trade and religion should have taken different routes. The only direct evidence that the northern route was used at all, at any date, comes from Ptolemy. On the other hand, the importance of the southern route through Wakhan is brought out, not only by the archaeological evidence

which Sir Aurel Stein's own explorations have provided, but by the Chinese records.

This is a problem on which geographers, archaeologists, and historians all have something to say. As I am not a geographer, I can only deal in what I may call geographical probabilities. Experts such as Professor Mason and Sir Aurel Stein, to whom we owe so much of our knowledge of the Pamir massif, assure me that the northern route is much the easier of the two. But I think that the archaeologist and the historian can only accept that proposition as a *prima facie* indication of facts which have yet to be proved. We have to ask ourselves whether there are not factors in the history of Central Asia which would upset assumptions drawn from geographical data.

Admittedly the history of these regions is sketchy, but in attempting to piece it together, I think that we do find some facts to suggest that the route which is geographically speaking more difficult was nevertheless the more popular. The Chairman said that the routes round the Tarim basin have no direct bearing on the relative importance of the routes across the Pamirs. With this I do not entirely agree, because the history of the northern oases of the Tarim basin explains why (as I think) the Silk Route described by Ptolemy may at an early date have been eclipsed in importance by the southern or Wakhan route, as regards both trade and the meeting of cultures. We find repeated reference to the occupation of the northern oases of the Tarim basin by Huns and other peoples. It was natural that, as a result of shortage of pasture or of political convulsions on the Eurasian steppe, nomads should occupy the oases on the northern fringe of the desert. The Turks, for instance, occupied Kashgar long before they made eastern Turkistan a land of Turks. It must have been infinitely more difficult for China to maintain communications along the northern route by way of Turfan and Kashgar than it was to reach Khotan from Kansu along the southern rim of the desert, and to travel on *via* Wakhan to the emporia of the West and to the homelands of Buddhism in India. In other words, political conditions in the north of the Tarim basin, of which we have some historical evidence, may have made it more difficult for traders and missionaries to pass that way than along the southern route, despite its greater physical obstacles.

I hope that in answering the Chairman's arguments as best I could, I have neither shot him dead nor presumed to trespass on territory which is not my own. The Buddhist route through Wakhan has not yet been explored by the archaeologist, and the relative importance of ancient routes across the Pamirs is one on which we may perhaps be allowed to differ. For at present the evidence is so scanty that in this discussion we have not, I imagine, been searching for anything more solid than what I may call a working hypothesis. It is a problem which I hope future expeditions will be able to solve.

The CHAIRMAN: It comes to this: I am not dead, and the next stage is that we shall have to do all we can to get enough money to send Mr. Barger back to dig. I ask you to show your very hearty appreciation of his extremely interesting lecture.

RECENT COASTAL CHANGES IN SOUTH-EASTERN ENGLAND: A DISCUSSION

I. THE NATURE OF COASTAL CHANGES

J. A. STEERS

Afternoon Meeting of the Society, 13 February 1939

IN this discussion we are to deal with changes in progress on our coast-line. Physical geographers are much concerned with the evolution of scenery, and one of the many difficulties they have to face is that of the slowness of the evolution of the landscape. To some extent those studying coastal forms are free from this difficulty, for the coast is altering continuously, and often rapidly. For many reasons we need to foster an interest in these matters. To-day we are concerned with the scientific aspects of the matter, and the contributions to this discussion will illustrate some of the interesting problems with which the coastal physiographer has to deal.

Perhaps the most important general point to stress is the need for quantitative rather than qualitative work. We need far more exact knowledge of what is happening: we are too often guilty of statements that cannot bear analysis. Up to a point this is unavoidable: generalizations must needs always precede particularities. Furthermore, nearly all writers on a coastal problem are faced with the difficulty of getting absolute measurements. It does not however necessarily take away from the value of written work to realize this, because the inevitable shortcomings should inspire other and future workers to overcome such defects. It is clear for example that any one who writes an account of the evolution of a particular piece of shore-line must content himself with as careful an analysis as possible of the field evidence: he cannot do more than indicate the probable evolution of the forms discussed, and thereby is almost bound to omit important variations that have happened in the past. Mr. Borer has been largely responsible for the admirable model of the Wash, and he has made clear from that how important it is to reconstruct past conditions in order to understand properly present fluctuations. With this idea in mind I want to show how essential it is to collect and analyse available evidence of change in order that future workers may have a more definite basis upon which to build. To do this I shall have to select examples: it would be impossible in a limited space to elaborate each point fully.

To begin with one must try to study all features of a stretch of shore-line. Along the north Norfolk coast it is well known that the chief direction of movement of beach material is to the west. This is strikingly seen in Blakeney Point and Scolt Head Island.[1] It is therefore easy to conclude that all other features of that shore will illustrate the same phenomenon. But near the mouth of the Wash the shingle spits enclosing Hunstanton Golf Links and Holme Marsh have grown to the east. Off Wells there are small local eastward movements.[2] Near Sheringham the direction of drift definitely turns to the east—yet the shingle from Blakeney headland is continuous past Sheringham to Cromer and beyond.[1] The precise reasons for these differences

[1] *Geogr. J.* 69 (1927) 24–48.

[2] *Geogr. J.* 87 (1936) 35–46, and *Trans. Norfolk Norw. Nat. Soc.* 14 (1937) 210.

still remain undetermined, although general reasons have been discussed elsewhere. An interesting local change of beach drift appears to take place just north of Barmouth in Cardigan Bay. Northwards from Llanaber is the extensive foreland of Morfa Dyffryn along which material clearly travels to the north. South of Llanaber there is, as evidenced by Barmouth groynes, a slight residual travel to the south.[1] Yet Llanaber can hardly be said to mark a salient on the coast, and is roughly comparable to Sheringham on the Norfolk coast. Uncritical analysis would not necessarily establish these points.

Valuable evidence of continuous change, whether of accretion or erosion, can be obtained from tithe-maps and from a careful comparison of the various editions of the 6-inch Ordnance Survey maps. Many of the figures quoted in the Royal Commission's report were based on this method. But the Ordnance Survey is rightly concerned with mapping rather than with physiography. Hence many details, *e.g.* of individual shingle ridges, are not shown. What is more, the editions of the Survey maps are rather widely spaced in time, so that only total change is recorded in the new editions. If a comparison is made between the Ordnance map and a physiographical map of Scolt Head Island it will be seen at once how much more detail is inserted in the latter.[2]

In order to establish the nature of coastal details in a selected area I have for about twelve years caused the western end of Scolt Head Island to be mapped. This is a typical fluctuating shingle spit with lateral ridges enclosing marshes in young stages of development. The mapping has been made each summer by plane-tabling. It may be argued that air photographs would be quicker and more accurate. On the other hand experience has shown that they are not too successful in enabling the investigator to pick out minor variations in the thin mud and silt layers which accrete inside the spit, and it is not easy to differentiate between sand and shingle, especially where there is much mixing. The intimate knowledge of the ground that follows from plane-tabling is of real value. Omitting details, the following points emerge from a comparison of the several maps[3]: (1) the fluctuations in the spit; (2) the weakness and ephemeral nature of any small "cape-like" projections; (3) the effect of storm winds from varying directions and their relation to the tidal range (this point is not apparent from the maps, but some of the differences in the maps can be directly related to particular conditions); (4) the changes in the distribution of sand and shingle, and also of sand blown up into dunes; (5) dune erosion; (6) the gradual evolution of the enclosed sand-flats from the earliest stages up to the development of true salt marsh. Since this annual mapping was started perhaps the most significant change took place in February 1938, when a severe storm from the north-west coincided with a high sea-level. The predicted tide (it was eight tides before the highest of the cycle) was not very high, but with the help of the wind the water rose to abnormal heights and did much damage. This was the tide that caused so much damage at Horsey.

It would be valuable to have similar maps made of other areas liable to like

[1] Unpublished data.

[2] *Geogr. J.* 83 (1934) 479–502.

[3] For a fuller discussion, see *Comptes Rendus*, International Geographical Congress, Amsterdam, 1938, vol. 2, Section 1, Cartography, p. 162.

changes. The maps are essential: however adequate a written description may be at the time, it is difficult to assess its value after some years, especially as the spit itself will almost certainly have changed in that time. It is only by constant observation and mapping that we shall obtain a final and clear idea of the precise conditions under which recurved ends (laterals) are formed. In addition, each coastal form needs special study: there will probably be great similarities in the evolution of like forms, but their exact development in different parts of the coast will not be the same.

Probably the clearest and most noticeable example of rapid change is in the growth and erosion of dunes. Every one must have seen how quickly small dunes grow round plants of *Agropyrum* or *Psamma*. The individual hummocks soon join, and a foredune is built. This will probably continue to grow until for some reason, such as the formation of a new shingle ridge in front of the dune, the sand supply is cut off. Similarly, old dunes often disappear rapidly. Ordinary dunes are seldom closely plant covered, and it needs but a rabbit-scratch or a deep heel mark to expose the bare sand. If the scratch is made on an exposed place the wind will soon enlarge the hollow, and may eventually produce a blow-out. Moving dunes are also common features, and may advance on to cultivated land. The most spectacular example in our islands was the final obliteration of the Culbin Estate on the Moray Firth.[1] Along parts of Cardigan Bay there are extensive dune systems, and by way of examples two sets of measurements may be quoted:

	Approximate length of advancing dune line	*Average rate of advance in fastest place* [2] 1901–38
1. Morfa Harlech ..	About $\frac{3}{4}$ mile	*c.* 12 feet a year
2. Morfa Dyffryn ..	Nearly 1 „	*c.* 20 „ „

Dune advance may be checked in various ways, either by the careful planting of *Psamma* or by fostering a growth of conifers inside the dunes and allowing time for the trees to grow before the dunes reach them. Dune growth in the natural state is haphazard: the dunes grow higher in parts, and the cols become wind scours. But where it is necessary to conserve the foreshore, dunes have to be carefully tended and "smoothed." Near Horsey, before the breach was formed, the north and north-east winds blew much sand over the dunes on to their lee sides, where it was held by planted *Psamma*. On the seaward side faggoting and similar processes were employed to cause the newly blown sand to fill up all hollows. The general crest-line was also kept fairly even. Before the breach, to be described by Dr. Mosby, was made the waves cut away the lower parts of these dunes. This material would be expected to travel eastwards along the shore. Mr. S. W. Mobbs, Engineer to the East Norfolk Rivers Catchment Board, tells me that much of it may have gone to feed the sand-banks which lie offshore. Whilst this is, of course, unproven, he has good reason for thinking that far less material during recent years has been

[1] *Geogr. J.* 90 (1937) 498–528.

[2] These figures are only approximate, and are based on detailed mapping carried out for the writer in 1938. The Ordnance Survey does not indicate lines of dunes as distinct from sand accumulations in general. The reader will probably know of other examples.

carried eastwards along this part of the Norfolk coast. This is the more curious if considered in relation to the numerous cliff falls between Cromer and Trimingham. If this state of things continues, it will sooner or later make conditions difficult at Horsey once again, and it demonstrates the necessity not merely of observing the conditions at one particular period but of keeping a record of the conditions over a long period.

Less observed but often far more significant, and even rapid, changes take place in salt marshes. The accumulation of mud and silt behind protecting shingle or sand ridges, a common phenomenon but too often dismissed as uninteresting, is part of the same process that goes on in sheltered bays or inlets such as the Wash, and Mr. Borer makes reference to it. The problem however is made more interesting because it is so closely bound up with plant ecology.[1] Briefly, a salt marsh develops in the following way: mud and silt are gradually deposited on a substratum, often of sand; the deposited material is carried in by the tide and dropped in sheltered places, and also at slack water. Halophytes, usually preceded by algae, and graded according to the nature of the substratum on which they are growing and to their level in relation to the amount of tidal inundation, gradually spread. They seldom form a continuous covering, but grow in clumps. The clumps spread laterally and upwards, and cause the tidal water which formerly spread over the flat as a thin sheet to become more and more constricted into channels. In this way creeks are usually formed, *i.e.* by the upward growth of the marsh. Similarly small hollows, salt pans, are often left in those places not covered by vegetation.

The rate of sediment accumulation is a vital factor. Professor F. W. Oliver [2] was, I believe, the first to suggest spreading a thin layer of distinctly coloured material on the marsh surface, and later to measure the silt deposited above it. The more important factors which govern the rate of sedimentation are: (1) distance from a creek along which the tide ebbs and flows: accretion is usually greatest near the creek banks; (2) average height of the marsh: accretion is usually more rapid if the marsh is plant-covered and frequently inundated by flooding tides; (3) the nature of the vegetation: the thicker the plant cover the faster is the accretion. Where *Obione portulacoides* flourishes this is very noticeable. In addition there are many minor and local factors, such as the slope and exposure of marsh surface and type of vegetation, which influence sedimentation at any point. In order to illustrate the nature of the process two sets of figures are given from the Dovey [3] and Scolt Head Island [4] marshes. The two tables are not strictly comparable in detail, and the types of marsh are also different. The Dovey marshes, apart from the *Juncetum* and *Salicornietum*, resemble a close-cut sward, whereas the Scolt Head marshes are not grazed and the plant cover is more variable, and the individual plants grow bigger. The Dovey marshes are in an estuary shut off from the open sea by a shingle bar; the Scolt marshes lie behind the island and in between the laterals. The Scolt table is based on figures I have

[1] See A. E. Carey and F. W. Oliver, 'Tidal lands,' 1918; also 'Scolt Head Island,' ed. J. A. Steers, 1934.

[2] 'Blakeney Point in 1915–16,' Report, p. 16.

[3] F. J. Richards, *Annals of Botany* 48 (1934) 225.

[4] *Geol. Mag.*, January 1938.

obtained from five different marshes, and has been analysed in its present form by V. J. Chapman.[1] As the Scolt figures are based only on twenty-one months' accretion, Chapman's interpretations must be regarded as approximate only. He concludes that for an open marsh to pass from the *Salicornietum* to the *Juncetum* stages would take up to two hundred years. A closed marsh (*i.e.* one nearly shut in, and with only a narrow mouth, between two laterals) will develop more quickly. Historical evidence suggests that Holme Marsh (a closed marsh) may have developed in little more than seventy years.[2]

Apart from the factors mentioned above, the rate of accretion will clearly depend very greatly on the available supply of material carried by the tidal or other waters. For this reason different marshes are not strictly comparable.[3]

SCOLT HEAD ISLAND

Island zero level is 7 feet above Newlyn Ordnance datum

	No. of sites	*Range in height above zero level*		*Average rate of accretion per annum*
Salicornietum[4] ..	8	−0·90 to	+0·40	0·68 cm.
Asteretum	22	+0·40	1·30	0·98
Late Asteretum ..	4	1·30	1·90	0·90
Limonietum	5	1·90	2·30	0·80
Armerietum	5	2·30	2·90	0·36
Plantaginetum ..	3	2·90	3·30	0·42

DOVEY MARSHES

Plant association	*Accretion in cm. in 100 lunar months)*		*in 54 lunar months*	*Land height in feet above level of bare silt at river end of line*		
Lines	I	II	III	I	II	III
Glycerietum ..	6·61	3·50	3·67	1·65	1·25	1·15
Glyc.→ Arm. ..	5·53	6·29	6·93	1·53	1·55	1·64
Armerietum ..	3·53	3·70	4·09	2·13	1·42	1·67
Arm.→ Fest. ..	2·00	3·32	—	2·85	1·87	—
Festucetum ..	1·75	3·31	3·38	3·24	2·23	2·31
Fest.→ Junc. ..	—	—	4·60	—	—	2·33
Juncetum	2·03	1·20	2·25	2·69	2·96	3·00

[1] *Trans. Norfolk Norw. Nat. Soc.*, vol. 14, 1938 (published 1939).

[2] *Geogr. J.* 87 (1936) 35–46.

[3] See, *e.g.*, D. W. Johnson, "The New England Acadian shoreline," 1925, p. 517; and Niels Nielsen, *Biol. Medd., Kbh.* vol., 12, p. 4.

[4] The termination *-etum* in ecological studies denotes an association. The suffix is added to the root of the name of the dominant species. Salt-marsh plants are graded according to the substratum on which they grow and according to their height on the marsh, which also determines how frequently they will be submerged by the tide. In each table the lowest plant association is at the top. The same associations do not necessarily occur in different marshes. For readers unfamiliar with these terms the dominant or "name" species of each association is:

Salicornietum	*Salicornia* spp.	Samphire
Asteretum	*Aster tripolium*	Sea aster
Limonietum	*Limonium* spp.	Sea lavender
Armerietum	*Armeria maritima*	Sea pink
Festucetum	*Festuca* spp.	Fescue
Juncetum	*Juncus* spp.	Sea rush
Plantaginetum	*Plantago* spp.	Plantain

Instructive changes take place with comparative rapidity on a marsh surface. On the largest individual marsh inside Scolt Head Island there has been left (see Fig. 1) a big area largely devoid of vegetation. On the lower side of this part, creek development is normal. On the upper side, just under the dunes, sand has, by high tides, been washed out from the dunes and formed a low "platform." With plant growth, especially *Obione*, this sand has been held, and small creeks left as a result of the spread of the plants. Across the bare area there are no true creeks. During a flooding tide the whole marsh is covered, and at the ebb the water flows back to the main channels, and in doing

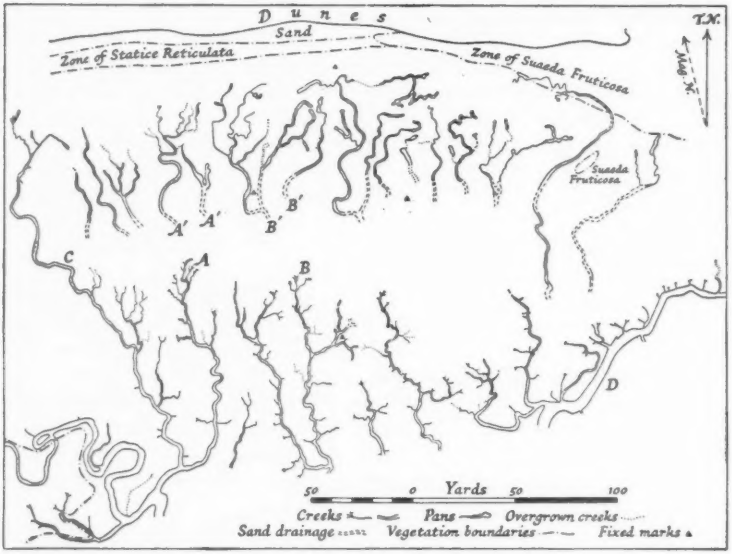


Fig. 1. Creek development on Hut Marsh

All the creeks on the southern side of the bare patch are cutting back rapidly at their heads, as shown at A and B. When the tide in the creeks has fallen below the general marsh level, the water draining off the bare patch causes a slight collapse of a small area near the head of each creek. The creeks become less well-marked as they approach the bare patch, and their pattern disappears, though the drainage follows fairly definite lines. The heads A and B show a tendency to approach A′ and B′. Creek C has already cut back and captured a northern creek. D is the major creek of the north-eastern part of Hut Marsh.

so runs off from the bare area into the creeks on its lower side. During this phase the water is actually cascading into the creeks, and so lengthening them by backward cutting. In this way they may lengthen appreciably in one tide. This process has been going on for some time, and it will not be long before upper and lower creeks meet. But with the development of creeks, and consequently of better drainage, plants spread into the bare area.[1] Hence not

[1] See also *Trans. Norfolk Norw. Nat. Soc.*, vol. 14, 1938 (published 1939), where other details of rapid change are given.

only is the whole space changing in the purely physical sense, but also ecologically.

A word may be said about the marshes at Talsarnau, in Tremadoc Bay (N. Wales). There is here an almost complete absence of silt, and the upper 6 inches or so of the marsh surface is merely finer soil, intertwined roots of

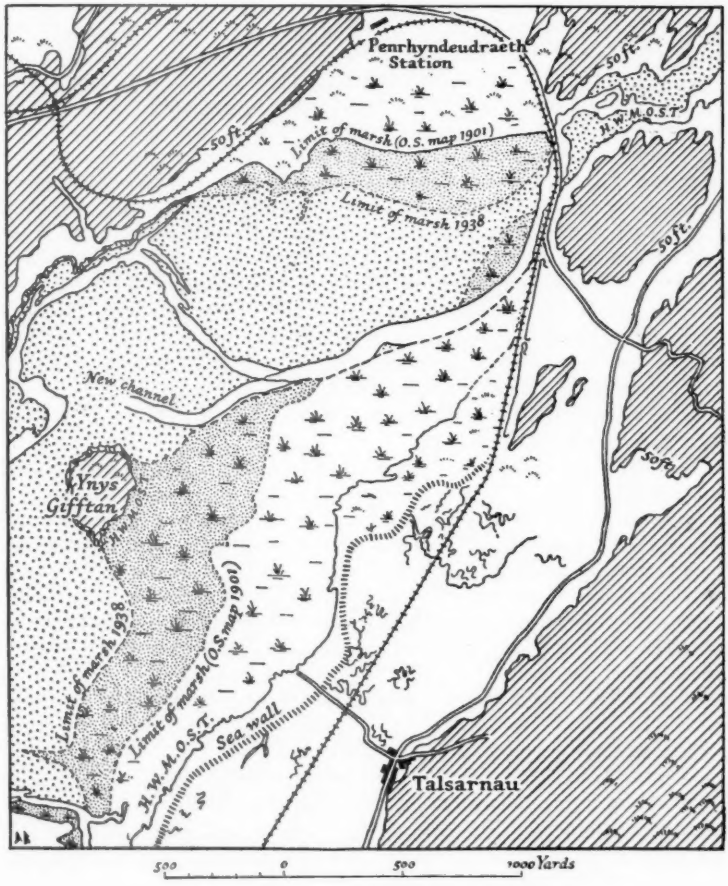


Fig. 2. Recent marsh growth in the Dwyryd estuary

grasses, etc., over the coarser sand below. Since the publication of the current edition (1901) of the 6-inch Ordnance map of the district, the marsh surface has extended as shown in Fig. 2. The creeks here are very different from those in Norfolk, and the loose sand below the surface layer is easily washed away and allows the soil layer to fall in rectangular-shaped blocks. In the larger creeks a narrow drainage channel is left, but in the smaller the under-

cutting process has often resulted in the formation of a chain of small pans or holes. The plates accompanying this paper serve better than a long description to illustrate the differences between typical Scolt and Talsarnau creeks of comparable size.

Marsh changes are perhaps small and apparently insignificant in themselves, but collectively they are important. The close interaction of geographical and other factors emphasizes the necessity for the cooperation of many branches of science to explain the evolution of an area.

There is one other obvious way in which rapid change occurs, namely cliff erosion. Here again accurate measurements are needed. In many places, *e.g.* Holderness and Suffolk, cliff recession has been more or less continuous for centuries, and it is still going on along many parts of our coast-line; yet it is extraordinary how little is known of the true rate of erosion. The newspapers often record severe cliff falls and estimates of their amount at so many thousand tons, but these have little scientific value. In some seaside towns the local surveyor will have definite figures, but there are long stretches of coast where falls may occur frequently and for which no quantitative measurements exist. If these could be made from some fixed point by competent observers, and the conditions under which the falls occurred noted, not only the geographer but also the geologist and engineer would benefit greatly. It might perhaps be possible for the Board of Trade to instruct their coastguards to make such observations and keep the full records available for reference at some central office.

The cliffs between Sheringham and Happisburgh are formed of glacial till and sands and gravels. Clay or loam seams often occur in the gravels, and they, as well as the till, are often contorted so that the limbs of the folds may frequently slope seawards. The falls are nearly all due to land water rather than to direct sea erosion. The waves, after a fall has taken place, remove the debris, and so help to prepare for another fall. The inclined clay or loam beds, when saturated with land water, form excellent sliding surfaces. Wind erosion of sand beds in the cliffs also produces falls, but usually on a smaller scale. These layers are hollowed out by the wind, and collapse of the overlying material follows. Falls of this nature are often noticed between Cromer and Sheringham. At Beeston Hill, east of Sheringham, the loose and complicated structure causes an almost continuous steady fall of sand and pebbles. This is accentuated in high winds. West of East Runton Gap there is an enormous chalk erratic in the cliffs which reaches nearly to their top. It is part of the till, and conditions are most unstable. The constant falls, caused by the undercutting by wave action of the sandy and clayey beds, yield vertical chalk faces. Marked instability also characterizes the cliffs between Overstrand and Trimingham. It is this part that shows curved and folded structures well, and when the dip is seawards cliff falls are frequent and often serious. The stable position is reached when the erosion has cut back into the landward dip. At Walcot a seam of sand is (1938) visible in the cliffs at about high-water level. As this is washed out the overlying till collapses and allows fairly rapid erosion of the low cliff.

Unfortunately actual recent measurements are not available of the loss on the Norfolk coast, and much of the information given above was sent to me

A creek in the Scolt Head Island marshes showing "Obione portulacoides"

Pans on Plover Marsh, Scolt Head Island

Headward cutting of a creek on bare patch, Hut Marsh, Scolt Head Island

A creek in the Talsarnau marshes, showing the effects of undercutting

by Mr. J. E. Sainty, of West Runton, who has noted the details of erosion, particularly in relation to his work on the Forest Beds and related features. As modern precise measurements are not easy to obtain, I quote from E. R. Matthews a note on the estimated loss on the Holderness coast.[1] "Assuming the average height of the cliff to be 18 feet, and the weight per cubic foot of the glacial deposit and boulder clay to be 120 lb., no less than 1,904,194 tons of cliff are washed away annually. . . . Assuming that the rate of erosion of 3 yards per annum has been going on for the past century, no less than 3052 millions tons of cliff have been swallowed up during that time. As to area lost, assuming that one acre per mile of coast-line has been swallowed up annually, and that loss at this rate has been continuous, no less than 66,600 acres have been swallowed up by the sea since the time of the first Roman Invasion." In 1890 Captain A. H. Kennedy (in connection with a committee appointed by the British Association in 1884 to inquire into coast erosion) reported fully and carefully on the loss in certain areas. The average erosion for the 6-inch Ordnance Survey, Sheet 213, Yorkshire (Aldborough), over a period of thirty-seven years, for example, is 237 feet. This is an example of rapid erosion in glacial till. Similar but smaller figures could be obtained for chalk and other cliffs.

Mr. Jolly in his contribution shows that it is more than probable that a slow vertical movement is affecting south-eastern England. Whilst this cannot be seen, it is important to realize its significance. The severe flooding of the Thames of January 1928 can be explained as a combination of meteorological and tidal conditions: Mr. Jolly has suggested elsewhere that it is also just in this way that the slow sinking would make itself felt.[2] If no increase in height were made in the sea-walls, a similar event might take place once or twice in a generation. In any case, we must see in this subsidence a continuance of the post-Roman subsidence, and possibly a continuance of the isostatic movements of the land induced by the Ice Age. Finally, reference may be made to a small point. Sudden erosion of cliffs or dunes may be the result of a related slow change. If a tidal channel, swinging mainly in one direction in sand-flats, comes close to a dune shore, bigger waves, at high water, are brought closer to the land, and erosion takes place. The severe but very local erosion near the clubhouse on Brancaster Golf Links (Norfolk) is due in part to the inswinging of Brancaster Harbour Channel.

Change of one sort or another is thus going on constantly along our coasts. It is often so small as to pass unnoticed in a generation: it may be so rapid that it is commented on in the press. We need careful measurements of all types of change, and we shall best help the future investigator if we can record accurately the details and causes. The geographer may be primarily interested, but he must work in close collaboration with his colleagues, botanists, engineers, and others.

Finally, may I note how difficult it may be to answer an apparently simple question such as: "Is this piece of coast gaining or losing?" On, say, a

[1] *Min. Proc. Instn. civ. Engrs.*, 1905. See also T. Sheppard, 'The lost towns of the Yorkshire coast,' 1912, chapter 1.

[2] *Comptes Rendus*, International Geographical Congress, Amsterdam, 1938, vol. 2, Section 2b, Oceanography, p. 56.

marshland shore erosion may be destroying the outer dunes; at the same time shingle bars (not necessarily above high-water mark) may be lengthening, and salt marshes within growing upwards. Meanwhile the whole area may be very slowly sinking. This may seem an extreme case, but it is not exaggerated, and serves to emphasize the complexity often inherent in a simple question.

II. SUPPOSED LAND SUBSIDENCE IN THE SOUTH OF ENGLAND

H. L. P. Jolly

Relative vertical movement of land and sea has played a great part in geological evolution. The process is however so slow that its detection by measurement rather than by inference is difficult. Since there are places where such movements have demonstrably gone on during the present and recent centuries and since those places are not very distant from our own shores, it is natural to inquire whether Great Britain shares in the movements. The known elevation of northern Scandinavia at a mean rate of about 1 metre per century and the depression of the Netherlands coast at rather less than a quarter of that mean rate might have been accompanied by elevation in the extreme north of Scotland and depression in the neighbourhood of the English Channel. The available archaeological evidence is very interesting and significant in this connection. It is quite clear that the land surface in the Thames valley has sunk about 15 feet with reference to tidal levels since the Roman occupation.[1] There is to-day a densely populated area of some square miles in south London which is from 5 to 6 feet below ordinary high-water mark. Further, on both sides of the western English Channel there is archaeological evidence of subsidence which may belong to the historical period. The evidence of such things as buried forests is also conclusive, but scarcely concerns the present discussion because it is related to too remote an epoch. An aggregate movement of subsidence amounting to 40 feet in the last ten thousand years would be quite consistent with a contrary movement at the present day.

The only method of detecting movement in progress is to keep a careful record of sea-level by means of one or more autographic and continuously acting tide gauges. This was one of the purposes for which the Ordnance Survey erected three tide gauges at Dunbar, Newlyn, and Felixstowe in the years 1913, 1915, and 1917 respectively. Another purpose was the provision of a datum level surface for the Second Geodetic Levelling of England and Wales, 1912–21.[2] The level of the sea at each tidal station is determined in relation to a so-called contact point on the framework carrying the gauge, and the height of the contact point is controlled by frequent levellings to the observatory bench mark, perhaps half a mile away. The latter itself is controlled by an annual relevelling to the nearest fundamental bench mark, which may be some miles away. These very necessary precautions ensure the

[1] See, *e.g.*, A. G. Francis, *The Essex Naturalist*, vol. 23, 1932, and R. E. M. Wheeler, Royal Commission on Ancient Monuments (England), London, vol. 3, p. 13.

[2] Ordnance Survey. Published H.M. Stationery Office, 1922.

detection of any purely local subsidence or a settling of the structure carrying the gauge.

Such evidence as exists for very recent subsidence in the south of England is contained in the accompanying Figs. 3 and 5. Fig. 3 shows, on a common scale of elevations, the annual mean sea-levels at the three tidal stations over the periods for which records are available. An annual mean sea-level for this purpose is the mean of all the hourly readings of sea-level from the chart, beginning on May 1, ending on the following April 30, and rounded off to contain a whole number of complete semi-diurnal oscillations. The zero or datum level surface is the so-called Newlyn datum, which is the mean of the 52,608 consecutive hourly readings from the self-registering tide gauge at Newlyn covering the period 1 May 1915 to 30 April 1921 inclusive. Several things are at once noticeable about Fig. 3.

The sea-level at Dunbar, as related to that at the other tidal stations through geodetic levelling, is seen to be nearly a foot higher than these. This phenomenon, not uncommon in the world at large, is to be considered real

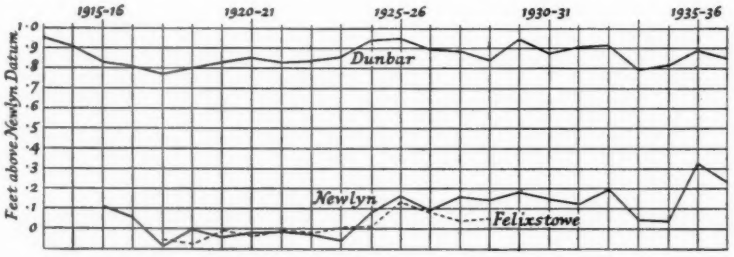


Fig. 3. Annual mean sea-levels

in this case rather than attributable to errors in geodetic levelling. The ascertained difference of height was in fact five times the probable error of the levelling from Newlyn to Dunbar. For this reason the Newlyn datum described above was taken as the datum level surface for the whole level network. It is the zero or base-line in Fig. 3. For present purposes it is not the height of the sea which matters but the change of height with time. It appears at once from Fig. 3 that the Dunbar record shows no aggregate change of mean sea-level over twenty-three years, but that both Newlyn and Felixstowe show an unmistakable rise during the twenty-one years and twelve years respectively over which their records are available.

The tide gauge at Felixstowe was, rather unhappily for some scientific purposes, handed over to another authority by the Ordnance Survey in July 1929, and was moved to a neighbouring site and lost its connection with the geodetic level network. This connection has now been re-established. Although the broad facts as to the behaviour of mean sea-level at the three stations are apparent, some doubt about the reality of land subsidence in the south of England may be occasioned by the rather large fluctuations in mean sea-level from year to year. This again is a world-wide phenomenon, a figure of about 0·05 foot being common as a probable annual fluctuation.

Further evidence is necessary before subsidence can be accepted as a fact. Patience and a further fifteen years of records will probably provide the answer. Impatience, perhaps not always a vice, has in this case led to another piece of evidence of some weight. To take means over periods longer than a year or to employ the well-known process of taking means of overlapping periods of years would of course smooth out the graph of mean sea-level, but it would prove nothing. It might be expected that the opposite process, that of taking means over shorter periods than a year, would fail to throw light on the question because it introduces greater fluctuations of sea-level than are shown by the annual means. The reason for its trial will appear below.

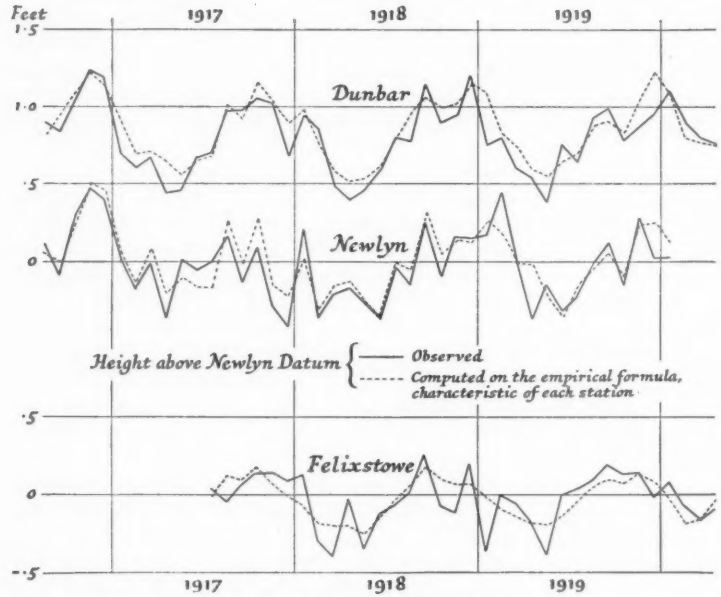


Fig. 4. Monthly mean sea-levels

Analyses of the monthly mean sea-levels at Dunbar, Newlyn, and Felixstowe over periods of seven years, four and nine-twelfths years, and two and ten-twelfths years respectively, all ending in the year 1920, were made in connection with the Second Geodetic Levelling of England and Wales by the Ordnance Survey, and will be found described in detail in the publication dealing with that work.

It was found that monthly mean sea-level at Newlyn could be represented with remarkable fidelity by a pure sinusoidal annual oscillation and a term inversely proportional to the monthly mean barometric height. The barometric constant was also almost exactly the "theoretical" value equal to the relative densities of mercury and sea water, so that the sea appeared to behave like a gigantic barometer, going down with high atmospheric pressure

and *vice versa*. At Dunbar the empirical formula, peculiar to the place, was a little less successful, though still good, and the barometric constant only half its theoretical value. At Felixstowe the correlation was poor and the barometric constant only a quarter of the theoretical value. Fig. 4 gives these observed and computed monthly mean sea-levels at the three stations over the latter part of the above-mentioned period of seven years.

It is clear that with such good correlation as exists in the cases of Dunbar and Newlyn some interesting results can be obtained by extrapolating the

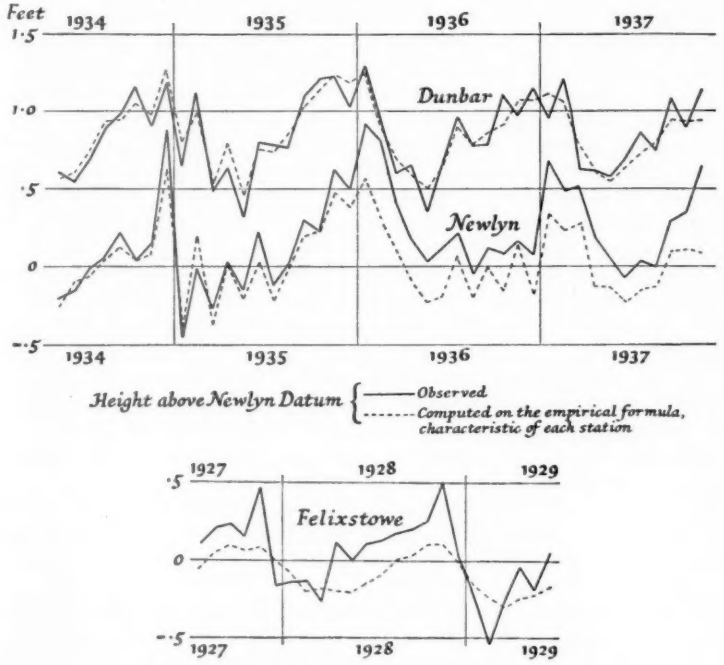


Fig. 5. Monthly mean sea-levels

empirical formulae over long periods and comparing the computed values once more with recently observed ones. Fig. 5 shows the result. A lapse of fourteen years occurs between the end of the period of Fig. 4 and the beginning of that of Fig. 5, except in the case of Felixstowe, where the interval is seven years only. The difference between Dunbar and Newlyn is striking. The agreement between observed and computed at Dunbar is even closer than over the earlier period used to determine the constants of the empirical formula. Clearly no change of relative level of land and sea has taken place there. At Newlyn the formula continues to represent the fluctuations of monthly mean sea-level with the same fidelity as before, but beginning with March 1935 the two traces part company and, with one very small exception,

do not again cross each other. Even the comparatively great depression of sea-level during the years 1933–34 and 1934–35 in relation to the surrounding years (see Fig. 3) does not apparently represent anything more than a return to normal level for the datum period 1915–21, nor does the computed formula fail in any way to represent the great fluctuations from month to month during the year 1934–35. This means that the cause of the systematic separation of the two traces over a period of two and a half years is not the same as the cause of the great seasonal fluctuations. No known meteorological influence can produce such a result.

The conclusion would seem to be that the changes of relative level of land and sea which appear to be thus systematic over years at a time are due to real movement of the land surface. The movements appear to be comparatively sudden and spasmodic and may have small movements of opposite sign superposed on them even in the course of a single decade. At Newlyn the movement seems at present predominantly downwards and, if we average it over the eighteen years or so separating the means of the two periods analysed, gives a rate of subsidence of about 1 foot per century, which happens to agree fairly well with the average rate at which the land surface has subsided in the Thames valley since the Roman occupation.[1]

The tidal record of Felixstowe, being less amenable to successful analysis as regards fluctuations of monthly mean sea-level and having only an interval of seven years instead of fourteen years over which to extrapolate, is not so conclusive. It does nevertheless show evidence of the same land subsidence.

The necessity of keeping a careful and continuous record of sea-level at several stations round the coast by means of precise autographic tide gauges is perhaps not generally realized, even in scientific circles. We find for instance that the Royal Commission on Coast Erosion, 1911, recommended that the Ordnance Survey and the Geological Survey should take steps "from time to time" to ascertain what changes of relative level of land and sea are taking place. It would appear certain that if tidal records were only obtained from time to time their interpretation in terms of relative vertical movement of land and sea would be still more difficult than now, if not impossible.

In addition to the re-establishment of geodetic connection with the Felixstowe tide gauges the Ordnance Survey has recently made similar connection with a tide gauge established early in 1938 by the King's Lynn Harbour Board. This gauge is too far from the open sea to give a reliable datum level surface for levelling (and is not required for such purpose), but it must in time bring to light any continuous vertical movement of the land which may be in progress.

The projected establishment of another autographic tide gauge in the north of Scotland and its connection with the geodetic level network now being completed there are clearly desirable at an early date. The question of relative vertical movement between one part of the land surface and another will be settled when it becomes profitable to carry out a third geodetic levelling of Great Britain. It will be remembered that a relative movement which appeared upon a comparison of the first (1840–60) with the second (1912–21)

[1] See also Captain T. E. Longfield, *Ordnance Survey, Prof. Papers*, New Series No. 14, H.M. Stationery Office, 1932.

levelling could not be accepted as a fact because of the inaccuracies of the older work. Since the present investigation is concerned with different relative movements of land and sea at different places, the third levelling will bring conclusive evidence to bear on the problem.

III. THE HORSEY FLOOD, 1938: AN EXAMPLE OF STORM EFFECT ON A LOW COAST

J. E. G. Mosby

On the night of 12 February 1938, during a north-westerly gale, high waves were driven against the sand-hills of the east Norfolk coast with such force that they demolished 517 yards of the dunes at Horsey. Salt water poured through this breach and flooded 7500 acres of low-lying hinterland. The sand-hills extend for about 9 miles and bridge the gap between two sections of sandy cliffs. On the north-western side the cliffs rise gradually to about 40 feet at Happisburgh, drop to about 6 feet at Bacton, rise rapidly at Mundesley, where they form part of the eastern end of the Cromer morainic ridge, and attain their highest altitude (220 feet) at Trimingham. To the south-east, about half a mile from the Horsey breach, the arrangement of the sand-hills is rather complex, and from this point, Winterton Ness to Winterton, the hills stand two or three deep between the sea and the marshland. These hills are not always parallel to the coast. At Winterton a double line of sand-hills, roughly parallel to the coast, stands between the sea and an old cliff; the angle between the cliff and the dunes being about 10°. The dunes join the cliff just south of Hemsby, and from here the cliff face lies exposed to the sea as far as Caister. These cliffs, which form the eastern edge of a former island, now the Flegg Hundreds, are low, the highest part being just over 50 feet. The sand and shingle spit on which Great Yarmouth is built extends for 4 miles from Caister, and at its southernmost point the rivers Yare, Bure, and Waveney enter the sea. Behind the sand-hills, the Flegg Hundreds, and Yarmouth there are more than 56,000 acres of marshland, all of which is under 10 feet in altitude and in many parts below the Newlyn datum. Relative movements of land and sea led to the formation of a shallow bay or estuary with outlets to the sea on both sides of "Flegg Island," and later these outlets were restricted by deposits of shingle and sand, and alluvial deposits accumulated within the old bay.[1] In the twelfth century or thereabouts mud embankments[2] were thrown up on each side of the rivers crossing the area, and subsequent drainage operations, carried out piecemeal, have been the means of reclaiming a large proportion of this area from waterlogged marsh. The number of shallow lakes, called Broads, within the area has also diminished, but about thirty remain. Breydon Water is probably a remnant of the estuary of the Yare and Waveney. The reclaimed land consists of a number of

[1] The details of the relative movement of land and sea have not yet been fully worked out for this part of Norfolk. It may be interesting to compare the Fenland area: see H. Godwin and M. H. Clifford, *Phil. Trans. Roy. Soc. London*, Ser. B, Biological Sciences, 229 (1938) 323.

[2] Records of these operations are extremely scanty.

drainage levels,[1] each separated from its neighbours by low mud banks and having its own drainage system. The surplus water is drawn off by ditches into the main or Commissioners' drain, from which it is lifted by powerful pumps into the river. In many of the levels the original pumps were wind-driven, but were replaced by steam-driven pumps during the eighteenth and nineteenth centuries; quite recently some electrically driven pumps have been installed. Within the area there are several small parts which stand out above the general level of the marsh. These were undoubtedly islands

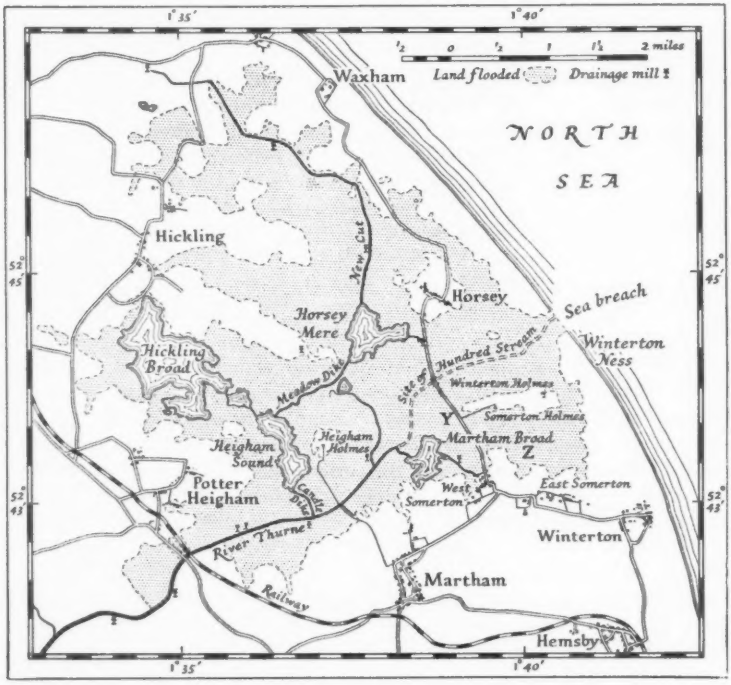


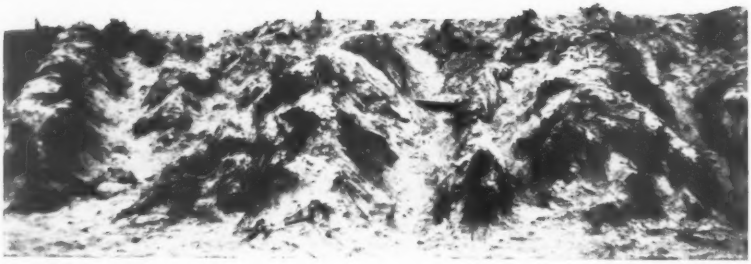
Fig. 6. Flooded area, Horsey and district, 1938

before the drainage operations, and those between Potter Heigham and the coast were high enough to escape the recent floods. Some of them still retain the word "Holmes" as part of their place-name, *e.g.* Heigham Holmes. Their names suggest that they were the sites of early settlements, and traces of old staithes are to be found in a number of them.

At the present time the only outlet to the sea for all the rivers and streams crossing the marshes is at Yarmouth. Previously there was another between the Flegg Island and Happisburgh, situated at the very spot where the

[1] The number of levels as stated by Mr. Francis Hornor is twenty-one; see Report of the Royal Commission on Coast Erosion, 1907, Vol. I, pt. I, p. 327.

Horsey floods, 1938
Aerofilms, Ltd



Runnels on the land side of damaged dunes at Horsey

E. A. Kent

The church tower at Eccles, 1887

Eccles church tower, 1938

breach occurred in 1938. This was called the Hundred Stream.[1] From the evidence available it seems probable that the mouth of Hundred Stream was still open to the sea after the river was embanked (probably in the twelfth century). Some of the old inhabitants affirm that sluice gates were placed at the mouth to prevent the sea water from entering the stream at high tide, and Mr. S. E. Thain stated that he saw the old posts of the sluice exposed soon after the recent flooding. In course of time the mouth became silted up, and eventually the gap between the sand-hills was filled in artificially.[2] I have been told that this gap in the sand-hills was filled in about two hundred years ago, but it is by no means clear whether this particular operation refers to the original closing of the gap or to the repairing of a sea breach at this spot. Faden's map shows that in 1792 the mouth of the Hundred Stream was completely blocked, and marks a road on the land side of the sand-hills connecting Waxham with Winterton. The same map shows an outlet from Horsey Mere to the Hundred Stream and an old drainage mill on the north bank of the latter; neither of these features exists to-day. Subsequent to the Horsey Inclosure Act of 1812 the waterway connecting Horsey Mere with the Hundred Stream was filled in and all the surface water from both the Mere and the Horsey Level reached the Thurne in the same way as it does now, by the Meadow Dike, Heigham Sound, and Candle Dike. From this time the Hundred Stream seems to have fallen into disuse. Its course was impeded when the road from Horsey to Somerton was constructed, and finally a dam was placed across it near the Martham end. The bed of the Hundred Stream is now virtually dry, but it is obvious that the floods of 1938 would have done less damage if the whole length of the Hundred Stream had been free from obstructions. The mouth of the Hundred Stream was farther north than one would expect it to be. The Yarmouth spit had diverted the Bure southwards, and it might be reasonable to consider that the Hundred Stream would have its outlet on the southern side of its own part of the marsh. The evidence that accretion has taken place at Winterton is indisputable, for the present position of the high-water line at ordinary spring tides is a quarter of a mile beyond the old cliff-line. Accretion can also be traced as far north as Winterton Ness, a point barely a quarter of a mile away from the outlet of the Hundred Stream. Taking into consideration the general arrangement of the old islands, such as Somerton and Winterton Holmes, it does not seem improbable that another island existed near Winterton Ness. The Ness itself is described[3] as a place well known to mariners, and a sea-mark, and was formerly a township. A lighthouse was erected there prior to 1588. Faden's map shows a lighthouse

[1] Documentary evidence of the early history of the Hundred Stream is extremely scanty, and the frequent use of the term "the Hundred Stream or Thurne" even up to 1921 sometimes leaves one in doubt as to which river the author refers. In this paper I use the name "Hundred Stream" for that part which is situated between Martham Broad and the coast—marked on my map as "the site of the Hundred Stream."

[2] "Formerly the river known as the Hundred Stream, or Thurne, used to discharge itself at Horsey through a gap in the sand-hills known as Long Beach, which is now closed by an artificially raised sand-bank." See Report of Royal Commission on Coast Erosion, vol. 1, appendix 23, p. 239.

[3] See Armstrong [Mostyn John], 'History and antiquities of the county of Norfolk,' vol. 4. West Flegg, p. 64. Norwich, 1781.

there, and a coastal map of 1843 shows two lighthouses at Winterton Ness; but neither exists now.

Records [1] dating back to the thirteenth century give descriptions of the more serious breaches of these sand-hills, those of 1287, 1608, and 1655 being particularly disastrous. Faden's map shows nine breaches which were made shortly before 1792, the year of the survey of this part of Norfolk by Thomas Milne. "In 1805 there were again several gaps, and the whole together, between Winterton and Happisburgh, measured nearly a mile." [2] Hewitt records that the repairs of these breaches were so serious that the Sea Breach Commissioners consulted William Smith. "He proposed to make all the new artificial embankments as like as possible to the natural embankments thrown up by the sea (and wind) on the same coast, to make them of the same materials, and to give them such directions as might best shelter the new work by the old." The breaches were repaired according to this plan under his supervision. During the great gale of 1897 [3] the tide reached the highest level on record along this part of the coast; and at Horsey it rose to 10·6 feet above the Newlyn datum. Considerable damage was done all along the coast; the sand-hills opposite the Hundred Stream were breached, and serious flooding ensued. Heavy seas continued to damage the sand-hills at Horsey in the early part of the twentieth century, and in 1907 the sea once again swept away the defences at Horsey almost immediately after extensive repairs had been made.

The cliffs on either side of the sand-hills are composed of soft materials of glacial or marine origin (unconsolidated sands, gravels, and clays). From Cromer to Happisburgh a stiff boulder clay occurs at the foot of the cliffs, and is sometimes exposed after heavy northerly gales. The boulder clay can be traced southwards past Eccles to Waxham, but it has not been observed opposite the Hundred Stream, although clay similar in character was exposed about a quarter of a mile to the south of it in February 1938. The mouth of the Hundred Stream was probably in-filled with peat and sand. Owing to the absence of boulder clay the foundations of the sand-hills at Horsey are naturally less stable than those of the dunes farther north. Rapid erosion has taken place all along the cliffs from Cromer to Happisburgh, and during the past decade this has been accompanied by serious landslides at Trimingham and Mundesley. The line of dunes has receded from Happisburgh to Winterton Ness, but the shore-line has been replenished [4] from time to time by material derived from the landslides and carried southwards by transport alongshore. The frequent formation on the beach of lows, often 5 or 6 feet deep and parallel to the coast, sometimes quite close to the base of the

[1] See W. Hewitt, 'An essay on the encroachments of the German Ocean along the Norfolk coast,' 1844; W. Rye, 'Maritime history of Norfolk,' 1902; Report of the Royal Commission on Coast Erosion, 1907–11; and *Trans. Norfolk Norw. Nat. Soc.*, vol. 14, 1938 (published 1939).

[2] J. H. Blake, Mem. of the Geol. Survey, Yarmouth and Lowestoft, p. 71.

[3] See the Report by Captain the Hon. F. C. P. Vereker, R.N., January 1898, to the Harbour Department of the Board of Trade as a result of an inquiry held at Martham on 30 December 1897 with the object of investigating the damage in the neighbourhood of Horsey caused by the inroads of the sea.

[4] See J. E. Sainty's explanation of shore-building, *Trans. Norfolk Norw. Nat. Soc.*, vol. 14, 1938 (published 1939).

dunes, makes wave-attack easier. The submerged sand-banks parallel to the coast, on the other hand, afford some protection when the wind is due east, particularly to the section between Winterton Ness and Yarmouth. Lyell, as a result of his examination of the foundations of Eccles church, suggested that the coast-line here was sinking gradually, and it is interesting, but not conclusive, that the Second Geodetic Levelling of 1912–21 gave the new levels of the area as 13 inches lower than the old figures, after making allowances for the difference between the Newlyn and the Liverpool datum.[1] The rise of ordinary spring tides should be also taken into consideration. The least rise (6 feet) is at Yarmouth. At Horsey the rise is $7\frac{3}{4}$ feet, but the altitude of the water at ordinary spring tides is 3 feet above the Newlyn datum.

From 1924 to 1934 there were no very serious north-westerly gales, and vast quantities of blown sand were piled up in front of the dunes and the cliffs at Happisburgh and Eccles. At the southern end of Happisburgh the sand reached 20 feet up the cliffs and completely covered the lower cliffs adjoining the dunes.[2] A heavy gale in December 1936 did a great deal of damage by removing large quantities of material from the beach, while waves swept away the base of the recently accumulated sand-banks. In the following year more sand was removed from the front of the cliffs and dunes.

On the night of 12 February 1938 the high tide at Horsey was 10 feet above the Newlyn datum, 7 feet higher than an ordinary spring tide. A north-westerly gale was blowing with great force, and heavy seas washed away the marram-covered face of the bank. At a later stage the waves overtopped the defences, and as the water ran off on the landward side it cut deep runnels, weakening this side of the bank. Soon after the tide began to ebb a length of 517 yards collapsed, and water rushed through the new breach, sweeping away gates, fence posts, stacks of hay, and reeds. The rush of water was so strong that it carried away a wooden bridge [3] for about three-quarters of a mile until it was stopped by a belt of trees.

Immediate steps were taken to repair the breach, and by the end of March a 7-foot barrier of bags filled with sand and clay placed behind a line of wooden piles had been erected across the whole length of the gap. This was high enough to keep out the highest ordinary tide. On April 3 a north-westerly gale with a velocity of 50–70 miles per hour produced waves which washed over the new defences at high tide. The battering was so severe that nearly the whole of the material—piles, sandbags, and the light railway that had run along the top of the barrier—was swept inland. The subsequent flooding was not so extensive as that in February, and no fresh ground was affected.

Mr. N. G. Parkinson, one of the engineers working on the new defences, gives the following as the sequence of events necessary for the maximum

[1] See part II, above.

[2] For details of the training of the sand-hills on this part of the coast see part I of this discussion.

[3] This bridge, connecting Somerton Holmes with the Horsey–Somerton road, crossed the main drain running parallel to the road. Its original position is marked Y on Figure 6, and the spot marked Z indicates the place where it is still to be found caught up by trees.

tides at Horsey. First, prolonged south-westerly winds driving the eastward-flowing currents of the North Atlantic; then a sudden shift of wind to the north-west about the Shetlands to divert the currents into the North Sea, during which contrary south-west winds in the Channel hinder the discharge of the piled-up water. Records of former breaches which give details of wind and tide almost invariably mention a combination of strong north-westerly gales and spring tides. From the evidence of such records and the experience of 1936 it appears that such a combination is more dangerous than the shifting wind described by Mr. Parkinson.

The total area flooded was 7469 acres, and the distance along the outside margin 43 miles, while the combined length of the shore-line of the islands amounted to 9 miles.

The task of draining off the water from the flooded levels was stupendous, for the whole volume [1] had to be pumped out of the marshes into the higher level of the river Thurne, or into the New Cut and its connecting dikes, Meadow Dike and Candle Dike. The progress of this operation was impeded by the lack of gradient in the rivers, and by the roundabout way the water had to travel to reach the only outlet at Yarmouth.

The flood water was drained off the Martham Level in twenty-eight days. During this time the drainage pump was working day and night continuously. Fortunately this level was not affected by the second inundation. It took sixteen weeks to clear the levels east of Candle Dike. After they had been drained the marshes looked desolate in the extreme. Instead of a fresh green the eye was greeted by a dismal rust-red. Trees were killed, even the insects exterminated, and the fish in the broads and rivers also died. It will be several years before the marshes are free from the disastrous effects of the salt water, especially those parts where the water was deep and remained for the full sixteen weeks.

The character of the land flooded was: arable, 752 acres; grazing ground, 3459 acres; osiers, 47 acres; woodland, 174 acres; rough ground, 1660 acres; sites of buildings, gardens, etc., 86 acres; broads, reeds, ronds—including Breydon Marshes, 1291 acres; a total of 7469 acres. Nearly all the land classified as "rough ground" was formerly farmland, *i.e.* arable or grazing ground, which had, by 1937, become overgrown with reeds, rushes, etc.

[1] With the exception of water taken off by making cuts in the river banks on levels where the flood water was actually higher than river-level.

(*To be concluded in the* Journal *for June*)

A NEW TRANS-AFRICAN ROUTE

A. E. FILBY

PIONEERING is necessarily leisurely. When, with Mr. M. F. Staniland, I took a car on the first motor journey ever made down the west coast of Africa, it took us nearly nine months, but our route, when improved and straightened out, will save over 3000 miles on any other now recognized between the North African seaboard and Cape Town.

I have, in the past six years, motored over all the main arterial throughways of Africa, and for clarity of description I have divided them into seven. They include three desert crossings, a main east-to-west route, and, including the one I have just opened, three that run roughly from the equator to the south.

The one that runs from Cairo *via* Wadi Halfa, Khartoum, and Juba, continuing through Uganda to Nairobi, can be described as both difficult and dangerous; in parts there are practically no marked tracks and one must travel by compass, as it is impracticable to follow the Nile. From Tangier the desert is crossed by what is generally known as the Bidon Cinque route, which passes through Reggane to Gao, and offers in my opinion the fastest crossing, as the surface is firm for the greater part of the way. It suffers however from a paucity of points of supply, so that necessities for man and car have to be carried. On all the other routes, except the one I have just done, supplies are available at frequent intervals. The third desert route runs from Algiers, and is being improved yearly; in fact it can already be described as a road. A normally fast car can reach an efficient supply point at the end of each day's run, but the rugged country, though picturesque, makes rough going for nearly the whole way.

The east-to-west route is joined by those I have just mentioned. Leaving Dakar, it is at first poor, but after Bamako becomes a fine highway by which one may reach Zinder, or branch through Nigeria on the way to Fort Archambault, Stanleyville, Irumu, Nairobi, and Mombasa. From this route a fine road runs from Nairobi *via* Tanganyika and North and South Rhodesia into South Africa. Passing entirely through British territory, this is known from Cairo to the Cape as the All Red Route. The route which leaves the east-to-west one at Irumu is now known as the Royal Route, and the Belgian authorities are doing a great deal of work to make it a trans-African highway. It passes through the Parc National Albert and some of the finest and most interesting scenery in Africa, and continues through to Albertville, Elizabethville, and Ndola in Rhodesia, where it joins the South African network. But it must be remembered that any one of these routes may be impassable in the rainy season or owing to extreme heat in the desert.

The route which Mr. Staniland and I have just completed leaves the east-to-west one in Nigeria and passes through the French Cameroons, French Equatorial Africa, the Belgian Congo, Angola, South West Africa, and the Union of South Africa. The following are extracts from my daily log and a route-sheet compiled after we left Jos in Nigeria.

Jos is a busy mining town where we picked up emergency stores, as we did not know what conditions we should have to encounter on the route to

Léopoldville. We soon got off the plateau into the scrub country, and there was very little game about, beyond an old duiker and Dorcas gazelle. The skin of the latter is highly prized by the natives, who believe that if their wives sleep on it they will not be barren. On this strip of road the bridges had been washed away by flood water, including one just erected at a cost of £3000, but the floods had subsided and we were able to ford the rivers. We took a

Sketch-map showing the routes described by the author

short cut from Bauchi to Gombe, where we found that all the white residents were up-country.

At Numan we crossed the Benue river on an efficient ferry and continued to Yola. From here it was our intention to make directly for Garoua, only 70 miles away in French territory, but we were told that the only route was a very narrow track through rocky country deeply worn by the feet of thousands of slaves in the days when they had been driven to the coast. We could not

take our car through this track, and were forced to make a detour of nearly 500 miles to get to Garoua.

There were very few natives about at first. The first we met when we camped amongst some bare granite outcrops of rock and found a man weaving on the most primitive of looms. These hills were alive with baboons, and their dog-like barks constantly echoed round our camp. After sundown the rocks began to cool and a high wind came up. It whistled round the crests of the hills and there was a tremendous crash when cracked masses of rock came tumbling down from the summit, sending smoke and showers of sparks in all directions. Before 3 a.m. it had become impossible to sleep, and we took to the road again.

Fording several fast-flowing streams, we came at dawn to Mubi. At Gwoza the police officer kept a large guard, as the hill natives are still somewhat troublesome. They appeared to be of much finer physique than those we had met further north. From here we crossed a dry river-bed into the French Cameroons, passing through the large native village of Ashigashiya, and continued over what was obviously No-Man's Land, occupied by a few extremely wild and unkempt natives. After a few miles we struck the main Maiduguri–Mora–Mokolo road, a pile of cement informing us clearly of our route. Thereafter we started climbing an escarpment where the road twisted among huge boulders till it reached a height of some 4000 feet. Hidden in folds of the hills and behind rock outcrops were the huts of the hill natives, and they would drop from boulder to boulder or run along a ridge like giant apes, hastily retreating to a higher point if we stopped the car. The road after Mokolo skirted a large valley that had towering sentinels of rock stationed along its lip.

Arriving at Garoua we were held up for a day by the river Benue. The water had gone down to such a low level that the road was some hundred feet from the nearest point the pontoon could reach, and we had to employ a gang of natives to build a causeway. We were now running through typical bush country, which calls for little description. Numerous small villages were passed, and after Duru we climbed a pass overlooking the source of the Benue and later ran through Ngaoundéré and Yoko, where the old German fort stands high above the surrounding country. The natives *en route* were a wild-looking crowd, and we found some difficulty in camping as they were often drunk and unpleasant.

We were already getting into the rains, and preferred when possible to sleep in a rest-house. The laterite roads were becoming very slippery, especially on the sloping banks of the small streams we had to cross. These streams had collected the thickest forest round them that we had yet seen; giant palms, mahogany, cotton wood, and others, so close together and tied up with creepers and covered with orchids and tree ferns as to make an almost solid mass. The bird life here was very plentiful, parrots screamed on almost every bough, and we saw many species that were quite new to us. We also saw our first chimpanzee feeding high above our heads, and later heard the fierce barking noise of what we took to be a gorilla.

Yaoundé proved to be quite a large town, and from there we were running through tropical forest, the road being lined on both sides by the ugly square

huts that the French seem to have favoured for the natives. Batouri was the last town we passed through before going into French Equatorial Africa. It is the centre for the marketing of paw-paw, coffee, rubber, hides, and tobacco grown in the district. The road was excellent as far as Berberati, where we were told that there was no road going southward and that we should have to make a detour *via* Bangui and down to Elizabethville of just over 5000 miles. However we stuck to our plans and started off southward proceeding to the small village of Salo.

We now entered even denser forest than we had encountered before, but later left it to run into the savannahs, open rolling downs covered with grass, and so down to the Sangha river. Here the forest was so dense that it was obviously impossible to continue, and we made arrangements to be floated down 150 kilometres to Ouesso. Although we had some trouble with our craft *en route*, our chief difficulties were the tsetse-fly and the lack of food. We were however able to shoot a number of knob-nosed goose, and with a few coarse fish which Staniland caught from the river and a small amount of native food, including caterpillars fried in oil, we managed to exist. This trip took us just over four days. At Ouesso we had great difficulty owing to the high bank, but the natives practically lifted the car ashore.

From Ouesso we were following a crude track cut through forest reputed to contain a vast number of gorillas. The grass was 6 feet high, and in many places the track was practically barred by fallen trees, but we were always able to get under or round them. On one occasion we found the curious creeper from which the natives distil the poison for their arrows, and learnt later that although this would kill a man within a short time if injected, it can be eaten with impunity. The French administration officers at Makoua kindly supplied us with petrol which we had to return on our arrival at Léopoldville. Primitive dugout ferries conveyed us across the many rivers; what bridges we found were made of giant logs laid lengthwise, and on more than one occasion our wheels got jammed between these and we had to lift the car out with jacks. At Fort Rousset the ferry was waiting for us with the paddlers in position, and as soon as we came into sight a uniformed bugler sounded a rousing call and then played us over to the other bank, where we were met by the whole of the white population.

From here we sometimes travelled at night through rather marshy country with night birds continually flying into our headlamps and the hood covered with fireflies. Thousands of grasshoppers proved a pest, as they jammed themselves into the radiator, causing the engine to boil. At Djambala we came upon natives stretching a large net made of creepers across a shallow valley and discovered that they were driving game into it. After Pangala and Mayama the road became appalling; soft mud, then soft white sand, then outcrops of rock, long climbs through high grass and, 50 miles from Brazzaville, a wait of five or six hours in a temperature of over 130° while a bridge was remade.

From Brazzaville we crossed Stanley Pool to Lèopoldville, climbed up to Thysville, and continued along an old railway line that gave us an excellent surface for some time. Leaving this, we followed a track that would make any switchback green with envy. Several villages were passed

through but were only notable for their curious granaries, made by lacing the fronds of the palm trees together well above the ground. Soon we passed into Angola. It is possible that the roads of Angola are good during the dry season, but unfortunately for us the rains had broken and we were in constant trouble. From Damba we could only keep our direction by following the single-line telegraph wire, but later we came to open park-like country and eventually down to the river Cuanza, where we had a very slow crossing just below some rather impressive falls whose lip, shaped something like a horse-shoe, must have extended for over half a mile. This again was a very bad tsetse-fly area.

We entered Mussende in a tropical downpour, and it was here that we decided to sidetrack to Lobito, a decision that proved nearly disastrous owing to the floods. Descending from the plateau, which was some 4000 feet in height, we gradually wended our way through a series of valleys with vast peaks on either hand. Here the country was a blaze of flowers. We managed to cross one river where the flood waters were piling up against the crazy bridge, which collapsed shortly after our crossing. The next bridge had gone, and it took us three days to dig away the bank and haul the car through the water. We then climbed again and had some nerve-racking moments skirting the washaways of the mountain track, with a drop of some hundred feet if the road gave way. Eventually we got to Lobito, being held up there by floods for nearly three weeks. When we left for Benguela we travelled for the major part of the distance in over 12 inches of water; fortunately the track underneath was mostly hard, and we only had to be dragged at a few points. From Benguela, where the walls of the houses were caving in owing to the constant rain, we had to take to the railway to Catengue, as all the bridges on the excellent mountain road had collapsed. From Catengue most of the bridges had been roughly repaired, but the track was terrible; later we had to ford each river, and there were a great number of them. In some cases the fording took us over a day. Before Sá da Bandeira (Lubango) we had to inspan sixteen oxen to cross a flooded area.

It would take too long to recount our adventures in Angola in detail. It was mostly a case of digging and hauling. At Sá da Bandeira itself we had almost a civic reception, as we were the first arrivals for nearly three months, even the train having failed to get through. The local paper published figures showing that it was the biggest rainfall for over twenty years: 306 millimetres in the first fifteen days of April. From here we carried the Government mail, and owing to the courtesy of the Army authorities we had ample man-power and bullock-power *en route*. At Quihita boys pulled us for several kilometres through the water, and at Humbe the commandant of Fort Roçadas sent two platoons of native soldiery to assist us in the crossing of the Cunene river, which was flowing over 9 kilometres wide. The low plains between Fort Roçadas and Vila Pereira de Eça were under water varying from a few inches in depth to 3 feet, and here Dr. Martins, who is in charge of the Government veterinary station, came with us with an unlimited supply of oxen and boys. Leaving the fort at 1 p.m. a very short halt for food was made while it was light: lions were plentiful, and we feared they would kill or stampede our oxen. Then on again until 4 a.m. next morning when we arrived at Mongua,

where we again stopped for food, arriving at 7 a.m. the following morning at our destination after a trek of 100 kilometres in forty-one hours. Considering the atrocious condition of the road, this trek must constitute a record.

Before crossing into South West Africa the car was dragged, completely submerged, through a large river. After this the going improved considerably, and we soon came on to Etosha Pan, a large desert-like expanse of sand. From here dry and very dusty roads took us through bush country to Windhoek and continued until we crossed the Orange river, where the water was so low that the pontoon could hardly be made to float. Then through more desert-like country and on to a quite excellent road to Cape Town.

NOTES ON DOGS AND SLEDGES IN THE QUEEN MAUD SEA AND CORONATION GULF AREAS

THE REVEREND H. R. ROKEBY-THOMAS

THERE are two types of dog hitches used in the Queen Maud Sea: towards the eastern end the fan hitch, the normal eastern Arctic style, is used almost exclusively, while towards the west the Nome hitch[1] is the usual fashion. For ease of upkeep and freedom for the dogs the fan hitch has much to recommend it, but it is generally acknowledged that there is not the same pulling power as with the Nome hitch; that stands to reason, as with the fan hitch the centre of motive power is so much farther from the sledge. On fair going the Nome hitch thus has a decided advantage. The protagonists of the fan hitch claim that in rough ice it is the only satisfactory way. I have never used the fan hitch myself, but I have seen it used and travelled in company with fan-hitched teams; I formed the opinion that it does not give as good results as the Nome, though half the work in hitching, unhitching, and looking after the dogs is saved.

The roughest field of ice I have ever crossed was in Victoria Strait between Putulik (Nordenskjold) and Lind Islands in 1936, and I do not think it would be possible to get much worse. It was dangerous to have the dogs too close to the sledge, as with the normal Nome hitch, but to meet such conditions I carried a spare section of towline, which allowed of the nearest pair of dogs being 12 feet from the sledge. It was quite satisfactory. When going through narrow spaces the advantages of the dogs being in pairs seem to me to be great; with the fan hitch there would be a tendency for the outside dogs of the fan to get tangled up among projecting ice. Possibly some of my eastern Arctic friends will join issue with me there; but those of them who have come to stay in the western Arctic are all converts to the Nome hitch and I have yet to see a fan formation driven west of Perry river.

Feeding is quite a problem at Cambridge Bay, when a large team is kept, as seasonal fishing and hunting are very uncertain. There are three white

[1] Called "centre trace" by some writers.

establishments: the Hudson's Bay Company, whose staff do not travel and consequently do not keep dogs; the Royal Canadian Mounted Police and Anglican Mission, members of both of which cover several thousand miles by dog-team each year, and both of which have had to use, on occasions, quantities of imported feed. It has been the universal experience here that cooked and imported feed, of no matter what kind, does not keep the dogs in as good condition as raw fish or, better still, seal meat.

In imported foods I have had the best results with a dog mash which contains meat and bone as well as corn meal. Mr. S. E. Carter, half-breed Eskimo and for a long time police special constable, who has had much experience with cooked feed, told me that a dog mash with these ingredients was the only imported feed used that would put fat on a run-down dog during the cold months. That is quite an important statement, as the R.C.M. Police have tried out a very extensive variety of imported dog foods, biscuits, tinned meats, and rice.

With regard to rice, the kind used is a cheap grade "broken rice." It has the advantage in a country where it is difficult to get supplies that there is a great difference between its original size and the bulk to which it swells when cooked. Cooking is very important, and must be thorough to be satisfactory. If water is brought to a boil in a large dog pot and the rice then slowly thrown in without stirring, it will swell up and cook without burning; if however it is once stirred, the stirring operation has to be repeated frequently. I have fed rice with $\frac{3}{4}$ lb. beef tallow in it for each dog, and found that while it would keep the dogs alive, it would not sustain them in good working condition in cold weather; for the warmer days of spring it might be more satisfactory, but there is usually abundance of seals then. I think this is a very general opinion with regard to rice and tallow, but some very experienced arctic men have had better than average results with it. Sergt. Henry Larsen, master of the R.C.M. Police Arctic schooner *St. Roch* which winters at Cambridge Bay, tells me that, when no native food is available, he favours a mixture of husky dog meal, corn meal, rice, and tallow. He is definitely in favour of using some rice. It is of course much better to substitute seal oil for tallow if it is available.

I have noticed reports of expeditions making long trips and using dog pemmican alone; and in many cases, to judge by their average day's mileage, and allowing for weight of load, ice conditions, etc., they have not made very good time for this part of the Arctic. Often the blame has been placed on the sluggishness of dogs, and I would suggest that this is to be expected when feeding pemmican, unless some oily food such as blubber or seal oil is used besides; a few ounces per day will make a great difference. At the moment of writing we are feeding twelve dogs at the mission, and for the past few months they have had an exclusive diet of fish. A week ago (it is now mid-December), there was with the very cold weather a noticeable falling off in "pep," although no unusually hard work was being done. A small blubber ration was added, fed alone in the morning on non-working days, and on working days with the usual fish in the evening. The pick-up has been remarkable. Incidentally a full diet of seal meat and blubber is preferable to any fish whatsoever, if it is obtainable.

For long-distance travelling, if available, I use fish dried and smoked, and small pieces of blubber about 2 inches square; about 2–3 lb. fish per dog per day with one square of blubber. In cases where it is necessary to go on short rations for a limited period 1½ lb. fish with the blubber would be sufficient, providing the dogs were in good shape to start with.

There is nothing more disheartening on a long trip than the slowing down of the dogs, and everyone who does much dog travelling experiences it at one time or another. I noticed a report of an expedition in Greenland where having a man out on skis ahead had been tried; while it had produced some results, it had not been entirely satisfactory. Generally speaking, I think it is a mistake to let any one go ahead of the team. It may liven up things for a while, but the dogs get used to it and it tends to spoil a good leader; the situation is then worse than ever, for the dogs become hard to drive for a while. I have found it a little more satisfactory to change leaders. The No. 1 leader will often pick up again after being put back towards the wheel for a while. In the present mission team we have three dogs trained to lead.

Rest is another important item. Dogs should be rested at least one full day in four on a long trip. Better average mileage will be made than by pushing ahead day after day without a break.

As regards the breed of dogs, I think for arctic conditions the local dogs would be hard to beat. There was a team of Siberian dogs in this district a year ago, and while they were remarkably fast over short distances with a light load, for big loads and long distances and adverse conditions they failed to come up to the local husky. There is now another team of these Siberian dogs at Wilmot Island, about which the same may be said. I have now three dogs that are part Greenland breed, including my second leader, and they seem to be little different generally from the local dogs: about the same size, weight, and speed, and the same general reliability under adverse conditions. The characteristics to look for in local dogs are big chest, short legs, and thick fur.

A half-breed trapper on Victoria Land told me that he always judged a dog by the colour inside its mouth: if black, the dog would be good, if light, probably not. That has not been my experience, nor that of George Grover, my Eskimo assistant. Nor has it been the experience of Sergt. Larsen, with whom I discussed the matter; but as the half-breed in question has been one of the most successful dog-drivers in the western Arctic, I think it is at least worth mentioning his theory.

The Queen Maud Sea and Coronation Gulf areas are interesting for a study of sledge travel for two reasons: the alternative styles of dog-hitches described above, and the variety of sledge types used.

The toboggan is hardly ever used here and it has been definitely proved unsuitable for the usual local loads. Its only merits are lightness and easy upkeep under fair ice conditions. A trapper operating from Richardson Island off Victoria Land has used a modified form of toboggan, attaching hardwood strips about 4 inches wide and 1 inch deep to the outside edges of the bottom boards, and icing the strips for coast travel. Using eleven dogs he claims it is fast and convenient for small loads with only one person. For exploration work in this area the toboggan is too limited to be of serious use.

The Alaskan (or basket) type sledges are popular among the few white residents for certain purposes, but are not used by the Eskimo. Their advantage is lightness, and under fair conditions they are useful for short trips. Under bad conditions and for long trips, where loads of upwards of 600 or 700 lb. have to be carried, they are generally not satisfactory. During the past five years I have used three sledges of this type and my experiences may be of interest.

A light 6-foot sledge, weight about 60 lb., has been much used for short trips of one day or less, and very fast time has been made driving seven or nine dogs, and carrying one, and sometimes two, people. In October and November, for visiting fish nets under the ice about 7 miles away from the mission, this sledge has been used a lot. The runners are steel. After November it gets too cold to make running on steel profitable. In November my Eskimo assistant has used this sledge on his trap-line, covering as much as 30 or 40 miles with seven dogs during the short daylight. All the main fastenings on this sledge are raw-hide lashings, and there is plenty of give at all points. The sledge was made in Alaska.

In the spring of 1936 I used a 10-foot basket sledge made in Edmonton. It was tried for the first time on a trip to Burnside river *via* Wilmot Island, over some very good ice conditions, but proved very faulty in design. The fastenings were rigid tie-rods instead of lashings, and it was much too light, weighing only about 75 lb. After about 250 miles the sledge was a wreck, in spite of the fact that only a light load was carried, and I had to obtain a native *komatik* to get home. I was accompanied by a native dog-driver and ten dogs.

A 12-foot Alaskan sledge obtained in 1937, of fairly rugged construction and weighing about 100 lb., has been found very useful. It is fastened by raw-hide lashings, equipped with a foot-brake, etc. For use even under fairly rough conditions, in early fall and late spring when mud runners are unsuitable, it has proved itself time and time again. I also used it on a 500-mile trip in the late spring of 1938. In the cold middle of winter however steel-runner sledges bear no comparison with the efficiency of the iced mud of the native *komatik*, and while I never tried the basket-sledge in very rough ice of the worst type, I feel sure it would not stand up to it. For work around the buildings, hauling freshwater ice for household purposes, etc., it is easier to use than the cumbersome *komatik*, and for breaking in pups the handle-bars and powerful foot-brake give maximum control over the dogs.

Under all conditions the native *komatik* has proved itself unbeatable as a general or only sledge. For any long trip of 600 or 700 miles or more it is indispensable, being the one type that can carry a big load under any conditions. Most of my travel has been done with a 14-foot *komatik*, with iced-mud runners. The sledge complete with iced mud weighs about 220 lb. The boards are white pine (*Pinus strobus*) $2^1/_2$ inches thick, 10 inches deep, and shod full width with $^3/_{32}$-inch steel. With this sledge, using seven to eleven dogs and loads from 500 lb. to 1100 lb. (including sledge), quite good time has been made. The boards were first drilled from both edges and spiked with 6-inch steel nails to prevent splitting. It has been used crossing some very rough fields of old ice and taken heavy punishment. First made in 1934, it is still in good condition. For long-distance travelling it has the disadvantage of lack

of length, and I am convinced that up to a point the longer a sledge the better it bridges the waved packed formations of the snow, and the more smoothly it runs. In accordance with this idea, in 1935 I used for a while a *komatik* made out of two basswood boards 16 feet by 12 inches by 2 inches. It was found that 12 inches was too high and 2 inches too narrow, and there was a lot of trouble with strained bench lashings in rough ice. On smooth going however the sledge was a startling success.

For the season 1938–39 I am using an 18-foot sledge made of red pine boards 2½ inches thick and 9 inches high, shod with hickory 2½ inches wide and ½ inch thick. With the hickory iced this makes a fine running surface. The hickory was previously tried out in 1935–37 on a small 8-foot sledge, which was used chiefly by the native interpreter from December to February for trapping. The advantages of hickory are that it is lighter than mud and less liable to break in rough ice. Its disadvantage is that it does not retain its icing as long as mud, and instead of icing up the usual once or twice a day, as with mud, it may on occasion call for three icings or even four. That disadvantage however may in the very cold weather be partly overcome by freezing a light coat of oatmeal on the hickory. In the cold weather oatmeal stands up much better than mud. It is harder to break, and in extremity is a reserve dog ration. It should be well cooked before applying. Uncooked oatmeal for runners is not nearly so successful.

For the 18-foot sledge eleven good dogs are enough, but thirteen or fifteen are better; though Patsey Klengenberg, a well-known half-breed traveller in the western Arctic, tells me he has found nine big dogs satisfactory on an 18-foot *komatik*. It was Patsey and his brother Jorgen (sons of the late Captain Christian Klengenberg, the well-known trader) who first advised me on the merits of the longer sledge, which they have both demonstrated to be the best for this part of the Arctic. It is not favoured by the Eskimo, who prefer 12–16-foot *komatiks*, since it costs more in the first place, and the Eskimo is often hard up for dog-power, sometimes making as few as five dogs pull a 16-foot *komatik*; in such conditions the weight of the bigger sledge is a telling factor. The long sledge (with sufficient dog-power) makes for more comfortable travelling and better load distribution. Thirteen dogs on a sledge of this type, pulling a 1000–1200-lb. load, can easily make a daily average of 30–40 nautical miles. It is not advisable on long trips to try and make more, but on short trips of 150 miles the ground should be easily covered in three days. If the dogs have been conserved during a trip, the last 60–75 miles of the home stretch can often be made in one day.

For width between sledge runners a good local average is 17 inches with the cross benches of the sledge 22 or 23 inches long overall. Lashings of *ookjuk* (bearded sealskin) are the best, with raw-hide *babbiche*[1] a close second. Coarse Holland twine makes a poor substitute, but is useful in emergency. Hardwood (oak) is preferable for the main benches (back and front), while spruce, or other suitable softwood, is adequate for the remainder, and has the advantage of lightness. One experienced Arctic traveller tells me that he usually has 1 inch difference between the inside width of the back and front benches (the back being the wider), and that this makes for easier

[1] Thick strands of leather, usually from bear or beaver.

running. I have never seen this tried by the local Eskimo, and other travellers of experience, with whom I discussed the question, failed to see any advantage. I mention it however because my informant travels with greater ease than any one I have ever seen.

In icing mud the kind of snow is important, as is also the temperature. During the coldest weather the Eskimo apply thin coats of ice only; as spring approaches thicker coats of ice which last longer are used, and seem to stay on satisfactorily. In the coldest weather thick ice goes white and chips. A bearskin mit is used for icing and the water is heated on the seal-oil lamp or primus stove until lukewarm. It should not be boiled.

Local ice conditions, of course, vary from year to year, but, generally speaking, Coronation Gulf is fair, and any rough ice is mostly new. On the other hand, the Queen Maud Sea always has a lot of old ice, which comes down from the pack *via* Victoria Strait. For instance, the best route to King William Land from Cambridge Bay is to go south *via* Perry river on the mainland, inside the islands. In 1936 I returned from King William Land by the north route and took thirteen days to cover the 280 miles. Large rough ice was encountered all the way from the mouth of Simpson Strait as far as Lind Island, and in one day (they were long spring days) only 10 miles was made. Rough hummock ice was everywhere, with an occasional small berg upwards of 80 feet high. The bergs were useful observation posts for selecting a route. Occasional polar-bear dens were seen and some fresh tracks, but no bears. At times the dogs would be out of sight of the sledge, going over a ridge, with the sledge at a 45° angle to the sky. There was surprisingly little trouble with breaking mud; and nothing but a native *komatik* would have stood up to the punishment. Travel in the Queen Maud Sea is difficult almost every year, and in the summer its reefs and abrupt soundings make it an extremely difficult piece of water to navigate.

AFRICA SURVEYED

AN AFRICAN SURVEY: a study of problems arising in Africa south of the Sahara. By Lord HAILEY. Issued by the Committee of the African Research Survey, under the auspices of the Royal Institute of International Affairs. *London: Oxford University Press*, 1938. 9×5½ *inches;* xxviii+1838 *pages; maps.* 21*s*

SCIENCE IN AFRICA: a review of scientific research relating to tropical and southern Africa. By E. B. WORTHINGTON. Issued by the Committee of the African Research Survey, under the auspices of the Royal Institute of International Affairs. *London: Oxford University Press*, 1938. 9×5½ *inches;* xiv +746 *pages; illustrations and maps.* 10*s* 6*d*

CAPITAL INVESTMENT IN AFRICA: its course and effects. By S. HERBERT FRANKEL. Issued by the Committee of the African Research Survey, under the auspices of the Royal Institute of International Affairs. *London: Oxford University Press*, 1938. 9×5½ *inches;* xiv+488 *pages; maps and diagrams.* 10*s* 6*d*

THE notions of pestilence and obscure dangers, of urgent missionary need and unlimited economic possibilities, which were for so long characteristic of accepted ideas of conditions in tropical Africa, have faded with surprising suddenness during the past generation. Knowledge of the actual problems of the present and of the potentialities for the future has however been restricted to small circles professionally concerned in African affairs. It is widely felt that old horrors have been ended, and that established European administrations can be left to carry out fairly straightforward plans of development, the success of which is only likely to be threatened by external political disasters. The dissatisfactions of specialists and the warnings of publicists have not seriously disturbed the feeling that African problems are secondary issues which Europe, the source of civilizing forces and of capital resources, would solve *ambulando* according to her own political and financial condition. Of basic contrasts in long-term policy and day-to-day administration between the different territories, of the new social and economic dangers born of European development which have risen to take the place of native evils, of the obstinate and unsolved difficulties of native agricultural development little is known by the generally well-informed European, while the knowledge of the experts is often narrowly confined either to technical issues divorced from their social contexts or to particular territories isolated from the general African picture. Of the probable long-term results of the present improvisations no one until now could speak.

The futility of framing comprehensive plans of social and economic development for a much-divided continent without the prospect of the political will or the financial resources to carry them into effect has largely restricted vision to short-term attacks on immediate issues. But in Africa itself a sense of the multiplication of related problems, which had to be met by local palliatives, had been growing for some time when it was voiced by General Smuts in his Rhodes Memorial Lectures of 1929. In these lectures was proposed the stock-taking of Africa which has now been carried out by the African Research Survey, for which we are indebted to the generosity of the Carnegie Corporation and the Rhodes Trustees. The difficulties political, financial, administrative, and psychological which confront any attempt to coordinate the development of Africa remain; but the field of effort is now mapped out. The shoals and currents are charted in this 'study of problems arising in Africa south of the Sahara,' and a number of general theses and recommendations are offered for the consideration of the Governments responsible for these vast territories.

One who dipped casually into this voluminous report might be led by its lucidity and simplicity of arrangement into thinking it merely a competent compilation of accessible data and of orthodox views, remarkable only for its range and size. In fact, it is remarkable for its brevity and for the sureness with which fundamental issues have been brought into the foreground, and for the skill with which detail has been used to portray the problems in all their complexity. The clue to this sense of unity and significance probably lies in the fact that Lord Hailey has never allowed himself or his collaborators to forget the simple but all-important fact that it is not an area but a body of some 145 million human beings and their future descendants that are the subject of their inquiry.

As Lord Hailey says in his Introduction with reference to current discussions of the value of colonies:

> "it is possible that history looking back in retrospect on the part played by Imperial powers in Africa, will be more concerned with the nature of the contributions which the European occupation will have made to the future of the African peoples, than with the profit or loss which the African connection may have brought to Europe . . . the type of civilisation which will ultimately characterize the population of so considerable a portion of the earth's surface is a matter of great concern to the world at large. . . . The special needs of Africa at this stage are for a more comprehensive study of the factors which determine the nature of its social development. . . . Africa presents itself as a living laboratory, in which the reward of study may prove to be not merely the satisfaction of an intellectual impulse, but an effective addition to the welfare of a people" (pp. xxiii–v).

The urgency of such a survey lies in the fact that the economic and political conditions of the many territories are becoming stabilized. The main lines of future developments are likely to be decided in the present generation. But the pressing needs of the administrations of the many territorial units restrict their outlook to their own internal conditions. Political organizations and economic policies which are likely to dominate social conditions for many generations are being consolidated with but little reference to the conditions in the continent as a whole. At the same time other possible developments are impracticable for lack of coordination between territories. To some extent this is at present inevitable, and in certain fields distinct individual policies may even be desirable; but in so far as such a situation results from the lack of an African view among the majority of the personnel who administer African territories to-day without knowledge of comparable or alternative developments elsewhere, it is a development under conditions of unnecessary ignorance.

It is this ignorance which the Survey seeks to dispel, and from this point of view it performs two main tasks. It affords a compendium of comparable and related data on every main aspect of human activity in Africa, domestic, political, economic, and scientific. It also puts forward proposals for the maintenance of the flow of coordinated information and, more important still, for the coordination of further investigation of the activities themselves. Every section includes detailed reviews of the special conditions and problems in the Union of South Africa and in British, French, and Belgian territories; but Portuguese areas have unfortunately been much less fully considered, while Liberia, a territory whose peculiar history and status might have been of considerable significance in a comparative view, has been omitted. A more adequate map of population density could have been compiled, and a key-map indicating the more important sites and peoples referred to in the text would have been a considerable aid.

The Survey opens with a series of short chapters on physical conditions, peoples, languages, population, and the objectives of government, in which are reviewed the essential conditions of African life and the nature of the political philosophies which may underlie the administration of backward peoples. There follow comparative studies of actual practice in the various fields of government. The resources of the various territories and their development are examined and compared in chapters on labour, land, and agriculture (forests, water supply, and soil erosion). The social and political superstructures that have been and may be erected on these foundations are considered in chapters on health, education, and economic development including mining, transport and communications. The review of scientific research and economic development is based in large measure on two detailed compilations of data by Dr. E. B. Worthington and Professor S. H. Frankel of Witwatersrand which have been published in full as separate volumes. The survey concludes not with claims for particular policies but with a moderate statement of the opportunities and needs for further research, and with proposals which Lord Hailey and his collaborators consider practicable for meeting these needs.

The reviews of the progress of cartography in Africa (Hailey, Chapter I; Worthington, Chapter II) reveal the lack of accurate surveys on which could be based topographic maps for the planning of more than the most elementary administrative services. Coordination even among the British territories has barely begun and the need for the speedy completion of the geodetic survey of at least the 30° meridian arc, on which much work has been done, is emphasized. British administrations, more than the French or the Belgian, have allowed themselves to be diverted by cadastral needs from the provision of the geodetic and triangulation frameworks essential for the economic and systematic production of accurate topographic maps. The economy that could be effected by international agreement on a single system of projection for a main topographic series for the whole continent, and by the adoption of the metric scale in British areas, is an instance of particular interest to Fellows of this Society of the need for coordination in future development.

The survey of the present state of ethnological studies in Africa also shows that the little that has been done suffers from lack of planning. While the scientific and practical importance of this research is forcibly conveyed, the suggestion that the objectives and methods of anthropological field work underwent a complete revolution a few years ago is valid neither for British anthropology nor for work in the African field. There are some surprising errors and slips in this chapter, such as the unsubstantiated claim that wild cattle and sheep are indigenous to Africa and that *Bos primigenius* formerly existed in the Nile valley; the confused use of the term Hamite whereby language appears to imply physical type or culture and *vice versa* is also unfortunate.

The fundamental divergence of the political philosophies which affect social development in Africa—between the Cape and the Transvaal traditions in South Africa, and, in the tropical dependencies, between French centralizing and assimilatory aims and the British efforts towards the development of local native institutions for the purposes of self government—are analysed in relation to their respective historical backgrounds. While the contrasts in theory between French and British policies remain, there are tendencies towards similarity in proximate administrative objectives. The merits of direct and indirect rule are most lucidly expounded in the conclusion to the chapter on native administration. There is shrewd comment on the tendency of recognized native authorities, even of their own volition, to become mere agents of the administration and to lose their truly representative status among their own

people. On the other hand, both France and Belgium are showing increasing realization of the superiority of "traditional" chiefs over nominated agents as effective collaborators in native administration.

In the chapters on "The state of the land" and "Agriculture" the backgrounds of present policies concerning rights in lands are reviewed, and the clear distinction is made between the issues involved in European land holdings and the question of native land rights. For the former there are not merely extra-African precedents but the whole weight of an established economic system in the homeland, and the essential question is "whether the state shall . . . insist on conditions [and] introduce terms which will secure it a share in the incremental value due to the general advance of the territory." On the other hand native African land custom, related to subsistence production and absence of population pressure, is being faced with new situations as population and opportunities for commercial production increase. In some areas land has already acquired an exchange value for the African and this change will inevitably spread.

There is nothing peculiar to Africa in the general direction which the evolution of land custom is taking, and great significance attaches to the ultimate conception of the form which native tenures should take. After reviewing the often unformulated attitudes taken in actual practice by different administrations, the Survey concludes that, while there is general agreement as to the value of giving security to the occupier and the general advantage of individualization of tenure, it must be emphasized that communal or collective tenures do not necessarily involve insecurity for the cultivator. Insecurity is indeed much more characteristic of the relations of landlord and tenant than of the collective system. It would moreover be premature to tie down cultivators to fixed areas before agricultural methods yielding better returns have been successfully established. We are thus brought back to the fundamental problem of modifying or replacing the systems of shifting cultivation and open grazing which dominate native African practice. And here natural conditions, such as low fertility, resulting from mineral deficiencies and the biochemistry of tropical soils, and the incidence of tsetse-borne disease which prevents the introduction of draught animals into many agricultural areas, are proving to be obstacles as obstinate to the European agronomist as to the native.

The opportunities for the development of plantation agriculture and its social and economic implications are fully discussed. It is shown that in fact there is only

> "a relatively small field in which the merits of the two systems [peasant and plantation agriculture] can come under effective discussion. . . . [The peasant system] offers, no doubt, the advantage of the cheapest form of labour, namely that of the family; it is elastic in so far that the native farmer can readily change from one crop to another in accordance with the returns obtained, and in the last resort can revert to food crop cultivation. Again, the use of cooperative societies and *societés de prévoyance*, organized instruction, controlled marketing, and grading of produce have removed some part at least of the grounds for the objection that a regular supply of produce of standard quality cannot be expected from independent native growers. But it remains the fact, that in a competitive market, in which quality and regularity of supply are of paramount importance the advantage still seems to rest in regard to the limited range of crops [sisal, tea, sugar, quality cattle, and more doubtfully coffee, cacao and palm oil], with the use of capitalist methods. Were it at any time proposed to apply that system on so large a scale as to take up extensive areas of land now occupied by natives, and to

convert into wage-labourers a considerable section of the present cultivators, British administration at all events would feel strong objections on political and social grounds, nor would such a procedure be in full accord with the modern tendency of French and Belgian policy " (pp. 982–3).

The problems of soil erosion in the sense of preventible erosion due to human interference are admirably set out in a chapter which takes account of both physical and social factors. The often overlooked difficulty of excluding the results of the natural erosion cycle and climatic fluctuations is squarely faced, and it is also recognized that an objective survey is impossible because the data consist so largely of incomplete and unrelated opinions. There is hardly a territory in tropical or southern Africa that is free from accelerated erosion in some form, and protective measures are nowhere effective. Control of the human factor is in general more difficult in pastoral than in dominantly agricultural areas, for the entire social and economic outlook of the African cattle herder is involved in the problem.

"The central element in soil conservation is . . . the maintenance on the land of sufficient vegetal cover to prevent damage by wash and wind and to safeguard water supplies. In Africa this resolves itself into four main problems: the preservation of existing forests and the afforestation of steep slopes and hill tops; the control of overstocking and the application of scientific pasture management; the protection of water supplies, and the reorganization of native agriculture, so as to extend mixed farming where possible and to protect cultivated land by terracing, cover crops, green manuring, strip cropping, and other means.

The main obstacles to the solution of these problems are two in number: lack of money and lack of African cooperation. . . . The needs of soil conservation . . . have not yet been reconciled with policies which were in operation before [it] was regarded as a major problem . . . On the one hand there is the desire to increase production as quickly as possible in order to raise the standard of living of the people; on the other hand, is the fear that . . . permanent loss of soil fertility and the ultimate impoverishment of the people will result. On the one hand, veterinary scientists control stock diseases with a resulting increase in the numbers of inferior cattle; on the other hand, District Officers found in many places that pastures are being destroyed wholesale. At one moment the introduction of ploughs may be urged, at another ploughs may be condemned as causing erosion; in one area the clearing of tsetse bush is regarded as an urgent health measure, in the next the tsetse is regarded as the preserver of bush and hence of water supplies . . ." (pp. 1107–13).

Such contradictions call for careful planning. But, despite some moves in this direction, such as the surveys by Sir Frank Stockdale, technical adviser to the Colonial Office, of agricultural problems of British territories in both West and East Africa (C.A.C. 270, 1936; and C.A.C. 345, 1937) and increasing conservation allocations from the Colonial Development Fund, no coordinated policy has yet been formulated for British territories. The organization of research within single administrations is the exception; machinery for cooperation between territories administered by different European authorities does not exist; and there is no organization which can serve as a clearing house for the whole range of problems involved in the conservation of the soils of Africa.

The lengthy chapters on economic development, mines, and transport, occupying nearly three hundred pages, together with Professor S. H. Frankel's contributory volume on capital investment in Africa cover a vast field, ranging from surveys of the rise and present complex organization of particular economic

activities to consideration of the social consequences of industrial development and labour migration. The important part played by surplus investment capital available in Britain is shown in the rapid growth of extractive industries and the loans obtained by the different territories. The analysis of the African share in world trade shows that although the average share is small, the contribution in a few specialized products is extremely important both for the world and for African economic prosperity. From Africa in 1925–29 for instance, apart from gold and diamonds, came the following percentages of world production of particular commodities: oil-palm products, 63; chromium, 50; cocoa, 24; groundnuts, 10. The actual course of African export trade does not show that administrative control by one power has in the past affected general access to the raw materials of a colonial territory; but the entrepôt trade has tended to remain in the hands of the colonial power concerned. As might be expected from the relatively greater predominance of African territories in their colonial empires, France and Belgium have taken far higher percentages of the exports of their territories than have Britain and the Empire of those from British territories. Similarly the African import statistics suggest that the mother country has a real though not overwhelming advantage which is probably inherent in the colonial relationship.

In the economic relations between European and native people it is made clear that recurrent problems, chief of which is the adaptation of native economies to Western capitalism, are also inevitably being tackled piecemeal and in isolation in the absence of a common policy.

> "The native economy of Africa is almost everywhere in a state of change. New knowledge, new markets, new contacts, new forms of transport, growing populations, the suppression of warfare and a new division of labour between the sexes are all contributing to break down the old framework of social and economic life. The need to pay taxes, the opportunity to grow export crops, and the desire to buy imports, are bringing the African increasingly into contact with world markets. . . .
>
> " To attempt to resist these changes would be profitless. But to guide and control them is not impossible, and the ultimate form of economic organization may depend largely upon decisions, as for example regarding the forms of land tenures, taken at this stage. The administrations in Africa have an opportunity which was denied to the earlier British administration in India, not merely by the existence of the strongly entrenched social customs of India, but by the dominance of the doctrine of *laissez-faire* at the most formative period of British rule " (p. 1431).

More perhaps than any others these chapters convey the immensity of constructive European achievement in Africa; but they also record the disruption of native life over wide areas and, what is more serious, the absence of any widely accepted code or of practicable machinery for the satisfactory long-term organization of native society under industrial conditions. Technique, equipment, and social institutions are needed in Africa to meet a transformation which is effecting in decades changes that have been more slowly achieved in Western countries on the basis of experience and free organization, developed and tested over more than a century.

In a penultimate chapter on "The future of African studies" are embodied the general conclusions and constructive proposals which emerge from this survey. Having demonstrated the inadequacy of existing services for handling even the more pressing problems of administrative and economic advancement in Africa, Lord Hailey urges the need for the development and coordination of research organizations and for implementing the results on an adequate scale. Although

the Survey pays tribute to the great value of past achievement of scientific research and its practical application in Africa, both under official direction and by independent organizations such as the International Health Division of the Rockefeller Foundation, the isolated character of these endeavours throws into relief the wider needs and opportunities that have not been met. Having concluded that the separate territories can severally provide neither the financial means nor the most favourable conditions for large-scale research programmes, and recognizing the impossibility of combining intensive investigation of specific problems with practical administration in either the social or technical sphere, Lord Hailey proposes that central research organizations should be developed in the Mother Country.

> " A metropolitan research institution is more likely than is a colonial service to attract the services of men who have decided to make their career in research; they are detached from the responsibilities of purely routine work; and so long as they serve a central institution they share in that scientific atmosphere, at once critical and stimulating, which can so seldom be found in a colony. . . . [But] there would still remain for the specialist services in the colonies a wide field of scientific activity in dealing with the many immediate problems which arise in their department of work " (pp. 1628–9).

This type of organization has already been employed by France and Belgium but finds little expression at present in Britain. The personnel of such organizations can from the start take an African view of their problems and rapidly gain experience of the varying conditions in different territories. Above all they should be able to collaborate among themselves and with the different administrations with a degree of flexibility that is at present impossible. The Europe of to-day is probably not ready for any formal coordination of research and social development for all African colonial territories, but there is fair prospect that were such institutions established in the several mother countries the supernationalism and the *esprit de corps* of science would promote valuable collaboration between them.

For Britain and British territories Lord Hailey envisages, not a central executive authority which would closely supervise all types of inquiry, but a body advisory to the Government which should be able to recommend the allocation of funds for a series of research organizations, each competent to plan and execute specific projects in the most efficient manner. The guiding mind of that advisory body will need the eye of a human geographer which will keep the entire picture of living Africa in view, and the genius to apprehend social realities and potentialities as well as the immediate achievements and techniques of the natural sciences as they may be applied to the land and people of Africa. Those convinced of the wisdom of his proposals and conscious of the immense ability and insight that have gone to the direction and coordination of this Survey will hope that Lord Hailey's genius and vision may be enlisted without delay for the even greater task of creating the means, the energy, and the good will essential to the realization of these proposals.

Two practical steps are indicated: the creation of a special fund for African research provided by the British Treasury, which would be administered by the central advisory body referred to above, without which no such development can be attempted; and the establishment of an African Bureau of Information.

The 'African Survey,' despite its vast and orderly accumulation of data is not to be regarded merely as a report on work done and in progress; it is also, and most vividly in the mind of its Director, a foundation for planning the future. Those who go to it for information on the present will find themselves inevitably made aware of this vital consideration.

C. DARYLL FORDE

A NEW EDITION OF MARCO POLO

MARCO POLO: the description of the world. Edited by A. C. MOULE and PAUL PELLIOT. Vol. I. *London: George Routledge and Sons*, 1938. 11½×8½ *inches; 596 pages; illustration. £6 6s net the set of four volumes, payable in amounts of £1 11s 6d on the delivery of each volume*

VOLUME II of this work, containing the transcription of a Latin codex in the Cathedral Library at Toledo, called *Z* by Moule, was published early in 1938 (*Geogr. J.* 91 (1938) 488). The appearance of Volume I enables the general scope and construction to be more fully appreciated. That a whole volume should be devoted to a single text proclaims its great importance to students of Polian research, and it is necessary therefore to explain why this Latin text is so important and how it has been used by the present editors to justify the claim that their translation (or, to be exact, that of Moule) represents "all, or nearly all, the extant words which have ever claimed to be Marco Polo."

Scholars are agreed that the Franco-Italian text *F* in the Bibliothèque Nationale at Paris (fr. 1116), dating from the first half of the fourteenth century, is the most important basic text. Although it does not contain any lengthy passages peculiar to itself, it is not a composite text like Ramusio, but an abridged version of the original as written by Polo's fellow prisoner in Genoa, Rustichello the Pisan. Benedetto has proved that the book was not dictated as formerly supposed, but written up from notes and information provided by Polo himself. It may be assumed that the manuscript thus produced was lengthy, as curious in its content as was the language in which it was written; its title, significantly, was not 'The travels of Marco Polo,' but 'The description of the World.' This title was fully justified, for Polo visited and described every Asiatic kingdom across the whole continent, and was the first European to give an account of many of them, and also of Madagascar and Abyssinia. In the Genoese prison, the Pisan produced as curious and jumbled a story of adventure and romance as any in the Arthurian legends he knew so well. Whether he believed or understood half of what he wrote is open to doubt; he was merely producing the best and most accurate account of his fellow-prisoner's travels of which he was capable in difficult circumstances. He added nothing of his own except the usual preliminary exhortation: "Lords Emperors, and Kings, Dukes, and Marquesses, Counts, Knights, and Burgesses . . ." which has been found almost word for word in one of Rustichello's earlier works, the romance of Guiron le courtois (also known as 'Meliadus' and 'Roman de Tristan'). The result was that from this great storehouse of curious and, in places, almost fictitious information copyists picked out what they liked or what suited the particular purpose they had in view. The uncouth French mingled with Italian and Oriental words led to numerous mistakes and mistranslations, and in course of time widely differing channels of manuscript tradition have come into being.

To Professor Benedetto gratitude is due for his thorough examination of the problem of the manuscripts, and if many points are still unsolved, it is now known to what main branch each manuscript belongs, which texts are the most important in the reconstruction of the lost original, and the part played by *Z* in Ramusio's version. Benedetto had called the Ambrosiana copy *Z*, but with the discovery of the Zelada text itself, Moule has called it Z^1, while the original text is now known as *Z*. The two closely resemble one another, but many errors had crept into the copy and the discovery of the Codex Zeladiano is of great importance. It is a curious text and although disappointing in some cases—the first part is little more than an epitome—contains many entirely original passages

usually of special anthropological and folklore interest. The additions made to the Polo *corpus*, counting all original words, parts of sentences, and whole passages, come to just over 2000. Of these 10 per cent. only can be regarded as "passages," and over half of these occur, with but slight differences, in Ramusio. The first addition of any length comes at the end of Ch. 59; it gives the only known description of Juguristan with its capital Carachoço, that is, Khara-Khojo of the Uighurs, described by Stein during his third journey to Central Asia. In Ch. 104 there are interesting variant readings to Ramusio, treating of the superstitions of the town of Cambaluc. Curious scraps of folklore and sociology occur in many places, *e.g.* the discharge of musk once every moon (p. 271), the lending of wives to strangers (p. 274), the carrying of poison for swallowing in emergencies (p. 280), the employment of eunuchs to guard women (p. 295), a detailed description of tattooing (p. 297), a curious account of Chinese virginity (p. 304), suicides due to passion (p. 337), lion catching (p. 348), a lengthy account of the Christians in Fugiu (pp. 349–50), the extreme cleanliness of the people of Maabar (p. 389) followed by an account of the "debtor's circle," taboo, the tarantula, and (pp. 393–4) the devi-dasis. In the chapter on Socotra (p. 425) there is a long description of whaling for ambergris and oil, and finally (pp. 475–6) a curious account of the "stoves" of frozen Russia. Thus even in this brief survey, it will be seen that much new matter has been added from *Z*. But it must not be forgotten that Moule has in no way used *Z* to the exclusion of other texts. If any of them can offer one authentic word that is unique it is inserted at its proper place.

As already mentioned the basic text is *F*, but apart from this Moule has used seventeen other complete texts, the great majority of which belong to the same general group as *F* (called the A group by Benedetto), while of MSS. based on a text earlier than *F* there is of course Ramusio, *Z*, as well as others of less importance (such as L^1, V^1, VB^2, and I). This has resulted in the production of what must be regarded as the nearest approach to what Benedetto calls O^1, the first lost copy of the actual MS. as compiled by Rustichello the Pisan. Thus after nearly eighty years of research one of the world's greatest books is revealed in scholarly and lucid fashion; and although the debt to Sir Henry Yule, and to more recent scholars such as Pelliot, Orlandini, and Benedetto remains great, it is to the profound learning of Moule that the present work is due. Pelliot's volume, which will deal with the proper names and oriental words, has still to appear.

There is no indication as to yet how far the vexed question of itineraries is to be treated, but special maps are being drawn for the fourth volume.

To return to the present volume, Moule contributes an Introduction containing information on a variety of subjects other than the history of the texts. The first section deals with the history of the Polo family. This has always been a very difficult section of Polian research, in which Professor Orlandini is the leading authority. The genealogical tree here printed is a revised version of that published by Moule in the *Journal* of the Royal Asiatic Society, July 1932, and gives references to the seventy-five odd documents collected and published by Orlandini in his "Marco Polo e la sua famiglia' (*Archivio Veneto-Tridentino*, 9 (1926) 1–68). Full use has also been made of an additional fifty-two documents relating to the family house and tomb of Polo, and these are printed in full on pp. 523–95 of the present volume. The whole question has thus been covered as thoroughly as modern scholarship will allow.

The next section (pp. 22–35), entitled the "Life and travels of Marco Polo," deals chiefly with the vexed question of dates. The most interesting fact is probably the new evidence collected by Orlandini with regard to the overland

journey home. In the will of Maffeo reference is made to a great loss suffered by the party at Trebizond on their return from China. The three in the party were doubtless Nicolò, Maffeo, and the younger Marco, but further details are lacking. A close study of all the evidence, together with Marco's own will, has however convinced Moule that he was no millionaire, in the modern sense of the word, and that in the pound sterling Marco's fortune would total about £3000 only.

The third section (pp. 35–9) discusses the house of the Polo family in the district of San Giovanni Grisostomo in Venice. A reconstructed plan of the house on a modern map is included. It should however be noted that few of the names in the plan are the official ones used to-day. Although all this is fully explained in the text, the map must only be used in conjunction with it, and the would-be pilgrim, on reaching the church of San Giovanni Grisostomo must look not for the Corte Sabionera but the Corte Prima del Milion which leads *via* the little Calle del Milion to the Corte Seconda del Milion. On the left he will see the much-altered medieval tower and portal, which his Baedeker will inform him is the sole remaining relic of the house. This unfortunately is not the case; as can be seen from Moule's plan it lay a little to the south-west of the site of the Polo house. To find any foundations that may remain it would be necessary to pull down the Teatro Malibran and possibly some of the surrounding buildings.

Then follows section IV (pp. 40–52) on the manuscripts, every word of which needs careful study, while another three pages explain the aim and scope of the present translation. The translation itself follows (pp. 59–490), and is arranged excellently and simply. *F* is printed in Roman, and all additional readings are in italics, while an appropriate letter in the margin shows clearly from which of the seventeen texts they come. Critical discrimination in the matter of selection has been kept to a minimum, so that the reader can form his own judgment as to the value of the variants and additions and decide whether what he reads represents part of the original or merely the addition of a too ambitious copyist.

Several notes and tables follow the translation, all important to the student, but the most valuable is without doubt the 'List of the manuscripts and early printed editions of Marco Polo' (pp. 509–16) followed by notes of those recently discovered, which were not included in Moule's previous list printed in the *Journal* of the Royal Asiatic Society.

In conclusion a warm word of praise must be offered to the printers, S. G. Bradshaw and Frederick Biss, and the publishers, Messrs. George Routledge, who have done their work most worthily. N. M. P.

REVIEWS

EUROPE

THE ENGLISH COASTING TRADE, 1600–1750. By T. S. WILLAN. *Manchester University Press*, 1938. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xiv+234 *pages.* 12*s* 6*d*

Bridging the wide gap between Tudor England and the Industrial Revolution, and stressing the essential continuity in the character of English commercial life, Dr. Willan's new book will be warmly welcomed by those who advocate the evolutionary view of economic life in this country. But if, as the author states in his conclusion, this analysis of the Port Books emphasizes still further the claim that recent work has tended "to make the so-called Industrial Revolution appear much less of a revolution than it did a generation or two ago," it must also be added that much of what was true of the seventeenth century had been true of an earlier period: the dominant position of London, for example, to which he draws attention, had been established long before the close of the Middle Ages, and agriculture had long ceased to be confined to farming for subsistence or for a small local market. What is essentially different is a growing dependence in the seventeenth century upon water transport to cope with increasing production at a period of deteriorating roads. The author rightly regards the coasting trade as an integral part of the internal transport system of the country rather than as an adjunct to its foreign trade, and thus links it up with his previous volume on river navigation during the same period.

The Port Books, whence most of the information is derived, contain a bewildering variety of products, though unfortunately they give little precise clue to the character of industry in the hinterland of the ports, for they include reshipments of native produce from other parts of the country as well as of goods from overseas. Nevertheless it is possible to trace out the broad lines of industrial activity, and, apart from certain well-known post-Tudor trends such as the rapid expansion of the coal trade, to which considerable space is devoted, and the decline of the Wealden iron industry, we are given interesting sidelights on numerous humbler aspects of English life, such as the competition of Cornish slates and imported pantiles for the roofing of a rapidly expanding London, the rising popularity of Portland stone, and the importance of Dorset as a source of tobacco pipe-clay.

The treatment is necessarily extensive rather than intensive, though by no means superficial. Chapters of special interest to geographers are those devoted to minerals, agricultural produce, and manufactured goods, and to broad regional treatment of the ports. There are some useful statistical appendices and a bibliography. R. A. P.

SIEDLUNG, WIRTSCHAFT UND VERKEHR SÜDOSTENGLANDS in ihrer Verknüpfung. By RUDOLF JUNGE. (Veröffentl. Geogr. Seminars der Universität Leipzig. Heft 11.) *Dresden: M. Dittert and Co.*, 1935. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches;* 132 *pages; maps and diagrams.* *M.*4.50

This publication is an example of a painstaking and methodical application of current geographical methods to the study of the modern economic activity of a well-known region. It includes a careful statement of the main natural features; a highly condensed view of historical development; and a detailed account of modern agricultural, industrial, and transport activities. Following these is a section devoted to the relations between human settlements, produc-

tion, and transport; and a conclusion demonstrates the geographical conditioning of these three manifestations of human activity.

As productive activities and transport occupy much the greater part of the author's space, it seems fair to comment in the first place on his treatment of these. He knows and has used quite competently the important statistical and factual sources, as well as the standard books on the region; he sets out the facts and figures in full detail and clearly. The relation of economic products to natural conditions is worked out well, as is the relation of traffic to economic and to some other factors in the region; its relation to such factors in a much larger world is also kept in view.

A reviewer who knows the landscape of south-east England at first hand cannot but put one critical point. It is of course true that every feature of that landscape to-day, natural and cultural, is the result of "geographic" factors, if we understand by that term all factors that have helped to shape the landscape. For a scientific purpose we must however know the factors—natural, historic, contemporary—in detail. In the second of these classes, the historic, the present study is weak, and from that viewpoint its treatment and conclusions are questionable. It is no doubt for the same reason that its treatment of the economic influence of cultural and other non-economic factors seems defective. One concrete example will illustrate the point: who could say that Dover Castle, an institution military and cultural rather than economic, has not had a profound economic influence on Dover and its surroundings?

The diagrams and diagrammatic maps are to be warmly commended; the author is fortunate in being able to use colour, but in both coloured and black-and-white examples he has worked out clear and interesting methods of presentation. A. F.

LES ALPES OCCIDENTALES. Tome premier. Les Préalpes françaises du Nord. By RAOUL BLANCHARD. *Tours: Arrault et Cie*, 1938. $10\frac{1}{2} \times 7$ *inches;* iv+336 *pages; illustrations and maps.* 100 *fr.*

In this beautifully illustrated volume Professor Blanchard gives us the first instalment of a major work on the Western Alps. Readers of 'Les annales de géographie' are already well acquainted with his work and that of his students on this subject. Professor Blanchard has been associated with Grenoble for nearly thirty-two years, and no one is better qualified than he to carry out this formidable undertaking. The present work is a series of studies of the small, isolated massifs that comprise the northern French Prealps. Professor Blanchard adopts the classical French method of description by *pays*, under the headings of structure, relief, climate and vegetation, agriculture and economic resources, the people and their habitat. The whole is closely correlated and special emphasis is laid on the tectonic influence throughout the geographical sequence. In the matter of tectonic history, the author expresses strong disagreement with M. Cholley's theories of peneplanation, concerning particularly Les Bauges.

By frequent comparison the reader is made aware of the unity of the whole prealpine zone as well as of the transitions: from the nappe structure of le Chablais to the Jura formations of le Vercors, from the humid north to the relatively dry south; at the same time the separate entity of each massif is fully demonstrated. There are a large number of maps and diagrams showing distributions, and forty-one admirable photographs illustrating land-form and settlement. A section of the 1/80,000 Staff Map precedes each chapter.

The next volume on the Great Cluses and the Alpine Furrow will be anticipated with great interest. H. O.

AGRICULTURAL ATLAS OF SWEDEN. Compiled on behalf of the Royal Swedish Academy of Agriculture by OLOF JONASSON, ERNST HÖIJER, and THURE BJÖRKMAN. *Stockholm: Lantbrukssällskapets Tidskriftaktiebolag*, 1938. 10×7 *inches; 176 pages; illustrations and maps*

The Scandinavian countries have long used maps to display information. This agricultural atlas is divided into four main sections: physical conditions influencing agriculture, production of crops, animal husbandry, and marketing problems. The maps in black and white on a scale of 1/8M are not on the detailed parish basis of the agricultural atlas of England and Wales, but only on the broader basis of either the twenty-four provinces or eighteen official agricultural regions. Despite this the maps are, by their draughtsmanship, extremely effective in revealing the regional nature of Swedish agriculture. The major physiographic regions have differing climates, and this fact emphasizes the regional background on the production maps. Crops are mapped, side by side, both as absolute figures and as a percentage of arable land. With livestock attempts are made to distinguish breeds where these are of interest. In the section on market problems, maps and diagrams are subordinated to the text, which traces the history of modern Swedish agriculture. In the earlier sections the text facing the maps contains brief historical statements with comments and statistics on the map topic. After a short note on agricultural education the atlas concludes with about fifty photographs. These have been chosen to convey the atmosphere of the different agricultural regions of Sweden as well as more technical points. All interested in Scandinavia, agriculture, or cartographical technique will find the volume stimulating, and will regret that Britain can offer nothing comparable. A. C. O.

ASIA

THROUGH CRUSADER LANDS. By Major C. S. JARVIS. *London: Sir Isaac Pitman and Sons*, [1939]. $7\frac{1}{2}\times5$ *inches; 104 pages; illustrations and map. 1s 9d*

Information and amusement are judiciously blended in this attractive account of a journey by car from Cairo across the Sinai peninsula, through Transjordan, and into Palestine. Major Jarvis is on ground that is well known to him, and travelling amongst people whom he both likes and understands. The title is well chosen, but the journey took in Petra, Jerash, and Haifa, all representing in the history of the country phases whose significance is not lost upon the author.

TO PERSIA FOR FLOWERS. By ALICE FULLERTON. *London: Oxford University Press*, 1938. $9\times5\frac{1}{2}$ *inches;* xvi+196 *pages; illustrations. 10s 6d*

THE WILD ASSES: a journey through Persia. By W. V. EMANUEL. *London: Jonathan Cape*, 1939. $8\times5\frac{1}{2}$ *inches; 352 pages; illustrations and route-map. 12s 6d*

It would be difficult to select two more different books to bracket together in one review. The one is intimate, leisurely, and charming; the other superficial, hurried, and rather irritating. Mrs. Fullerton and her companion eventually sat down in an unspoilt village near Kasvin and lived in close contact with the natives for some months. Her ministrations to them in sickness soon produced an atmosphere of confidence, enabling her to get to know and understand her neighbours as few Europeans have been able to do. They rewarded her by manifestations of gratitude, comradeship, and affection which are seldom anticipated by observers of the Persian peasant. A large collection of mountain

plants had been made by Colonel Sawyer in 1891, since when there has been much desultory collecting by many travellers. Mrs. Fullerton's attempt to secure the flora from a limited area over a longer period of time was a departure which seems to have yielded a rich harvest. The term *chahudar* for the village head man is an unusual variant for *kedkhuda*.

Travel performed at high speed in motor cars over well-travelled roads by a motley group is unpromising material for a book, even under the auspices of the National Union of Students. Mr. Emanuel has inserted short historical notes on the sights seen and places visited which will be of use to others following the same itinerary. The main point emerging is that the local officials of both Persia and Afghanistan get very high marks for dealing courteously with an abnormally large number of very privileged tourists, and knowing the meagre stipends of many of these officials, one feels that a large obligation to them personally remains. The statement that there are only two signposts in all Iran (p. 235) is nonsense, though many will agree with the author's opinion that the trans-Iranian railway, unjustified strategically or economically, finds its place as a symbol of national revival. The book is well indexed. A good plate of the mosque at Sultaniyeh is included in a baker's dozen of illustrations. The sketch-map showing the route followed from Tiflis to Herat and back to Baku is disfigured by a caricature of the mountain systems which offends the eye of any student of topography or structure. J. V. H.

GEOLOGY OF INDIA. By D. N. WADIA. Second edition. *London: Macmillan and Co.*, 1939 (*first published in* 1919, *revised in* 1926). $9 \times 5^{1}_{2}$ *inches;* xx+460*; illustrations and maps.* 24*s*

This book was first published in 1919 (though the writing was completed in 1916) and a slightly revised reprint was issued in 1926. The present second edition is almost a new work. Not only has there been unparalleled advancement in the interpretation of Indian geology within the last twenty-five years, but a very important share in the advances has been taken by the author himself. Until the present century most of the pioneer work was carried out by the British officers of the Geological Survey; in recent years an increasing proportion has been the work of Indians in the Survey and in the Universities, and it is of this group of workers that Mr. Wadia has now become the doyen. Compared with the first edition, the present book is only some sixty pages longer, but the whole has been reset, the marginal headings dropped, and a large increase in number of words per page thus made possible. The inclusion of a large coloured folding-map, on the scale of 96 miles to the inch, of India, Burma, and some bordering tracts, incorporating all official surveys up to 1937, is an extremely important addition and affords the most complete and recent map available. In both text and detailed maps full use has been made of such recent work as the surveys of Rajputana, Assam, and the western Himalayas. A comparison of the sketch-maps of the Pir Panjal Range (Plate XV) in the original and the present editions gives some clues to the advances which have been made by Wadia's own work. The Himalayas are quite as fascinating to the geologist as to the explorer and climber. Little by little their geology is being studied and every investigation tends to show that Himalayan structures are more complex than was previously believed and that they resemble, in the development of nappes and slides, the structures of the Alps. Special interest attaches to Wadia's work on the syntaxial bend of the Himalayan folds round a hidden north-western prolongation of the Deccan massif under the Punjab (Plate XVIII). There are important additions also in the chapter on physiography, but the modern study of geomorphology as understood in Europe and

America has scarcely yet been started in India. The same applies also to the detailed study of soils, which are dismissed in three pages.

The book was prepared primarily for students of geology in Indian universities. Doubtless for that reason references are restricted to about half a dozen important items which are listed at the end of each chapter and to a limited number of footnotes referring to specific points. One result is that the author appears to accept responsibility for a number of statements unsupported by reference to appropriate authorities. The serious reader outside India would doubtless appreciate a much fuller documentation, since it is difficult to check which statements are based on general reconnaissance and which on detailed survey. Wadia has utilized fully the services of Professor B. Sahni in the revision of the section on the Gondwana beds and also states very fairly the present evidence concerning the age of the Deccan lavas (now regarded generally as lower Eocene). On the other hand the work of certain non-official geologists such as C. A. Matley, C. P. Chatterji, H. L. Chhibber, F. D. Adams, and K. K. Matthur, scarcely seems to receive the attention it deserves. Actually Wadia fully acknowledges all this work in his contribution on the "Progress of geology and geography in India during the past twenty-five years" (in the Progress of Science in India, Indian Science Congress Association, 1938, *Geogr. J.* 91 (1938) 573) which thus forms a valuable adjunct to the book under review and supplies many of the missing references. L. D. S.

DURIAN: a Siamese interlude. By NOEL WYNYARD. *London: Oxford University Press*, 1939. 9×5½ *inches;* xii+232 *pages; illustrations and route-map.* 10*s* 6*d*

The authoress went out to Siam to marry an Englishman in one of the timber companies working the teak forests in the north of that country, and in this book she describes, with great vividness, the voyage out, her impressions of Siam, and the exciting adventures she met with there. To the reviewer, who knows the north of Siam well and has described it as an Asian arcady, this book brought mixed feelings. First and foremost, a keen desire to return. And yet he cannot imagine any other young bride being filled with a wish to follow in Mrs. Wynyard's footsteps, so dark is the picture she paints of the trials to be undergone. Let us hope that the title accurately expresses the authoress's true feelings. A durian is a large fruit with a thick, prickly skin and a creamy-white inside divided into quarters like an orange. The skin has a most offensive smell, but the fruit inside is considered so delicious that durian orgies are a feature of the season. To Mrs. Wynyard Siam is like a durian: unpleasant on the surface but delightful when you come to know it intimately. The reviewer will not quarrel with that description, but could wish that the authoress had given her readers a rather wider view of the beauties of the country. We must however rest content with graphic descriptions of adventures with the beasts of the jungle and in the rapids of the northern rivers. There is too a most interesting account of a midnight fishing trip off Hua Hin, the chief seaside resort of Siam.

Mrs. Wynyard writes well and her photographs are excellent. R. LE M.

FORGOTTEN KINGDOMS IN SUMATRA. By F. M. SCHNITGER. *Leiden: E. J. Brill*, 1939. 10×6 *inches;* xii, 228+xl (*plates*) *pages; illustrations and sketch-maps.* 6 *guilders* (*c.* 12*s* 6*d*)

This book deals as a whole with Sumatra. The fare offered is varied, including Hindu and Muhammadan remains; the habits of elephants; the adventures of Thomas Dias in Central Sumatra in the seventeenth century; and a brief sketch of the great Raffles. Particularly interesting are the photographs of the Batak

Si Galegale, a wooden doll used in connection with the cult of the dead. The head is marvellously life-like; the doll has jointed limbs, and is made to dance by means of a complicated system of strings.

Perhaps the most important part of the book is concerned with the megalithic monuments of Sumatra and their cultural associations and functions. In some places there survive only the remains; in others new monuments are still being erected. These monuments are associated with both the dead and the living. For example, elaborate stone coffins with carved representations of human beings and animal monsters are used as receptacles for the skulls of the dead; in the case of the living, stone monuments are erected to the accompaniment of ceremonial feasts; stone circles are also erected and used for council meetings. This megalithic culture comprises also the erection of dolmens, standing stones, and stone seats, as well as stone paving, stairways, and stone rice mortars in villages; it includes also phallic ornamentation, head-hunting, sacred trees, and rice-growing with its associated sacrifice of "carbou." It is found in Sumatra, more especially in the Batak country, and particularly on the island of Samosir in Lake Toba and on the island of Nias. Stone monuments occur in south Sumatra. During the past twenty years evidence has been accumulating to show that the Sumatran megalithic culture is allied to that of south-east Asia, particularly Assam. A similar culture exists widespread in Indonesia. It is also present in an active form in southern Melanesia, particularly in the New Hebrides, as is shown more especially by the work of Mr. John Layard and the late A. B. Deacon in Malekula and the neighbouring islands.

It is a pity that Dr. Schnitger did not take a little more trouble over this interesting book. Apart from many spelling mistakes, it contains no index. Moreover the excellent photographs are all placed together at the end of the book, and no attempt is made to indicate the pages to which the photographs refer. W. J. P.

[GEOLOGY OF SIBERIA.] Vol. I. Pre-Cambrian and early Palaeozoic. 363 *pages*. Vol. II. Middle and Upper Palaeozoic. 364–778 *pages*. Vol. III. Mesozoic and Kainozoic. 781–1358 *pages*. By V. A. Obruchev. *Moscow and Leningrad: Academy of Sciences*, 1935, 1936, *and* 1938. $10 \times 6\frac{1}{2}$ *inches; illustrations* (41 *plates*) *and maps*. 18, 15, and 27 *r*. *In Russian*

[HISTORY OF THE GEOLOGICAL EXPLORATION OF SIBERIA.] In four volumes. From earliest times to 1917. By V. A. Obruchev. *Moscow and Leningrad: Academy of Sciences*, 1931–37. $10 \times 6\frac{1}{2}$ *inches;* 153; 250; 354; 574; *also* 213 *pages of bibliography; portraits*. *In Russian*

At the beginning of the present century Eduard Suess in volume III of 'Das Antlitz der Erde' gave a brilliant synthesis of our knowledge of the geological structure of Siberia. The study of Siberia by Russian and other geologists began in the eighteenth century but no systematic survey was undertaken before 1889 when construction began on the Trans-Siberian Railway. It was at this period that Obruchev began his work on Siberia. In 1926 he published in German a book on the geology of Siberia—'Geologie von Siberien' (*Geogr. J.* 70 (1927) 490). The present work, which is in Russian, is a revised and greatly enlarged edition of the German text. Each volume is provided with a series of plates consisting of photographs, palaeogeographical maps, and stratigraphical tables, these last ending with the Devonian period. Vols. II and III also contain chapters designed to bring up to date the information given in the previous volumes.

Like all works of this kind this book on the geology of Siberia is in the main a compilation, an enumeration and a study of all available works on the subject.

As such it is valuable but not very readable. Fortunately to each chapter is appended a brief summary indicating the results achieved in the particular field and the conclusions to be drawn therefrom. Sedimentary deposits, igneous rocks, and ore deposits are described in minute detail. The book also attempts a correlation of the sedimentary deposits of Siberia with those of adjoining regions, but the task is not an easy one, for even within the Siberian area itself the correlation of sedimentary deposits, igneous rocks, and orogenic movements is still very speculative.

Obruchev describes the great progress which has been made in recent years in the study of the Pre-Cambrian rocks of Siberia and likewise of those of the Palaeozoic age. A certain amount of new data relating to the Mesozoic and Tertiary deposits of the less accessible areas of Eastern and Arctic Siberia is also given, but the data on the glacial deposits of Siberia are still rather scanty and allow of few general inferences. As regards the Pre-Cambrian rocks there is an attempted subdivision and correlation. The Lower Palaeozoic deposits present an alternation of typical marine (limestone), shore, and continental (red series) deposits. In the Upper Palaeozoic the sea partly withdrew and a continental mass emerged in the middle of Siberia, which persisted on the whole right through the succeeding periods. The precise age of the very important coal-bearing series of the Kuznetzk basin and the Tungusska basin is not as yet definitely settled, but all palaeophytological evidence points to its being of Permian age. The so-called Siberian traps (extrusive and intrusive dolerites and basalts) are mainly of Permian age, although similar rocks were erupted during the succeeding periods.

The three volumes of the 'Geology of Siberia' constitute a painstaking and very valuable piece of work, whose main function is to make available information otherwise difficult to come by.

The 'History of the geological investigation of Siberia' is a complementary work to the above, in that all the bibliographical references for the "Geology" are given in the "History." The method of citing these references may be rather confusing to the reader, as those prior to 1889 are numbered and those after that date are entered under their year of publication. The "History" gives much the same material as the "Geology" but deals with it in its historical order. Four volumes have been published to date, covering a period from the earliest date down to 1917. The fifth and last volume, which is not yet published, is to embrace the period from 1917 to the present day. In addition to the bibliography each volume contains a subject index and an index of fossil names but not, unfortunately, an index of place-names. S. I. T.

AFRICA

MOROCCO AWAKES. By Captain F. H. MELLOR. *London: Methuen*, 1939. $7\frac{1}{2} \times 5$ *inches;* xviii + 260 *pages; illustrations and sketch-map.* 8*s* 6*d*

The style of this book is clear and interesting, and its facts are both reliable and well arranged. The narrative is brought to the close of the year 1938, and is an attempt to trace the origins and development of the present political situation in Morocco. Wisely, the author has devoted the first three chapters to a summary of the beginnings, decline, and fall of the Moorish Empire in both Spain and Morocco. The development of the present political subdivision of Morocco into French Protectorate and Spanish Zone of Influence, under the undivided suzerainty of the Moorish Sultan who resides in the French Zone, is then traced, along with events in Morocco during the Great War. The following chapter deals with the origins and development of the Riff War until the sur-

render of Abd el Krim, the author rightly stressing how near to success the Riffians were, and how precarious was the position of Taza, and even of Fez, in 1925. The next chapter deals with events in the Spanish Zone from the defeat of Abd el Krim to the outbreak of the Spanish Civil War in 1936, while the succeeding four chapters are concerned with the course of events there since 1936. In these chapters the author gives from personal knowledge gained through much travel and conversation with Spaniards, Moors, and others, on the spot, an absorbing narrative of events, along with an account of new movements during these fateful two-and-a-half years, all of which is correct, although presented sometimes with a particular bias. The next five chapters deal similarly with events in the French Protectorate, tracing the rise of nationalist movements, and also include an outline of general progress there in native education, reforms of Moslem justice, medical services, etc. In the concluding chapter the author dwells on the difficulties which the fighting in Spain by Moorish tribesmen have created for the future, and also draws the conclusions expressed in the title of the book. The work is a careful account of contemporary events, with their background and implications for the future, in a part of the world which is no less important than the Iberian peninsula in the Mediterranean political struggle now in progress. The book, with its index, good end-paper sketch-maps, and interesting photographs, can be recommended highly.

W. FG.

THE ROUTE OF THE EXODUS OF THE ISRAELITES FROM EGYPT. By A. LUCAS. *London: Edward Arnold and Co.*, 1938. $7\frac{1}{2} \times 5$ *inches;* 100 *pages; map.* 3*s* 6*d*

ON THE TRACK OF THE EXODUS. By Lieut.-Colonel C. G. ROBERTSON. *London: Gale and Polden*, 1936. 9×6 *inches;* xvi + 108 *pages; illustrations and maps.* 7*s* 6*d*

Of learned and other books and articles on the subject of the Exodus of the Israelites from Egypt there is no end. Even in the days of the old Jewish historian, Josephus, men wrangled over the circumstances of the great event which stands at the head of Israel's national history, and they still continue to differ. The Biblical evidence is obscure when not conflicting, the topographical identifications are often highly precarious, and although the general period of the fifteenth to twelfth centuries B.C. is one of the best illuminated of all ancient periods, the contemporary archaeological and other evidence is apt to be ambiguous and even disconcerting as regards the possible dates, the reigning Pharaohs, and the political situation. Every Old Testament scholar has his own strong views on the subject, and it must suffice therefore merely to mention the main features of these two books, each of which is by a writer well acquainted with the terrain.

Mr. Lucas, an archaeologist with forty years' first-hand knowledge of Egypt, holds that the Israelites crossed by the northern or the southern end of Lake Timsah, proceeded to Elim, about four days' journey, and, taking the Nekhl route, made their way to the Gulf of 'Aqaba. Among other points of interest he discusses the places where the manna and quails were obtained; the latter have their regular season and time of migration (*e.g.* arriving on the north coast of Sinai about dawn), and he gives reasons for his view that the Israelite camp over which they passed must have been at the head of the gulf. The time-honoured identification of Sinai is admittedly relatively recent (about the third century A.D.), and Mr. Lucas identifies the famous mount with Mount Bagir in the district of Seir or Edom. He rightly recognizes that the Israelites are variously described as living as a pastoral people in Goshen and also side by

side with the Egyptians in towns; they were essentially a pastoral people, but the skill required for the construction of the tabernacle involved a people who had been living a town life.

Lieut.-Colonel Robertson's solution, based on a knowledge of strategy, transport problems, and other military matters, is more novel, not to say ambitious. The Israelites, once a nomadic, pastoral people, underwent a complete change in Egypt and Goshen. "A flotilla of ships and barges was the necessary complement to their life in Goshen," and we are to look upon the tribes as carrying on an active overseas trade: after all, the Biblical evidence does associate the tribes of Dan and Asher with maritime activity. Moreover the construction of the tabernacle implies that the Israelites were expert craftsmen, and the oppression or slavery which plays so pre-eminent a part in the "canonical" history was neither prolonged nor, however severe, did it involve all the people. The historic Exodus was certainly no more difficult than the great trek of the Boers from the Cape into the Transvaal; nor was there any journey "in flight." The Exodus was a land and sea operation on a grand scale, the people marching southwards as far as Tor (Arsinoe), while the heavy stuff went by sea. There were some three million souls to care for, and the Egyptians, only too glad to get rid of the Israelites, would have placed all their available shipping at the disposal of Moses. And so at Tor the Red Sea was crossed. It was a miracle far transcended, *e.g.* by the retardation of the rotation of the earth (Josh. x). The ships continued their voyage to the head of the Gulf of 'Aqaba, while a column proceeded by land. The forty years, the penalty for disobedience, were spent hereabouts, in the region of Seir. The land was fertile, crossed by caravan routes, and the Israelites were able to maintain their shipping in the ports. But this hold-up was their punishment for "refusing in any circumstances to fight for King and Country." The Rev. E. H. Thorold, Chaplain-General to the Forces, gives the book his benediction, and Mr. Isidore Wartski, *qua* Hebraist, accepts some rather striking etymologies and opines that the interpretation throughout "does not conflict with the Hebrew chronicle or traditions." He concludes: "The fact that the Israelites did undoubtedly develop into a seafaring people does suggest the idea of a combined land and sea operation." S. A. C.

(GUIDA DELL') AFRICA ORIENTALE ITALIANA. Supplem. alla Rivista mensile "Le Vie d'Italia." *Milano: Consociazione Turistica Italiana* [*Touring Club Italiano*], 1938. $6\frac{1}{2} \times 4$ *pages;* 640 *pages; maps and plans*

The Consociazione Turistica Italiana are to be heartily congratulated on this the latest addition to their series of guides. To have produced so complete a publication so soon after the Italian occupation of Ethiopia is a remarkable achievement, particularly in view of the still very unsettled state of the country. The first hundred or so pages are devoted to general information, including résumés of the existing knowledge of the geography, geology, history, ethnology, flora, fauna, and economy of this vast territory. The remainder of the book provides more detail in the form of itineraries, the centres of interest receiving reasonably full treatment. This mass of information, resulting from a great deal of travelling and a thorough study of available documentation, is ably presented; but the compilers are fully aware of the incompleteness of present knowledge of the country in many respects.

The history is related dispassionately up to modern times, when the Italian propaganda and press communiqué version of relations with the Ethiopian Government is followed, though this has been completely discounted by a number of authoritative Italian publications. The attacks on the former

Emperor are perhaps the greatest possible tribute to his efforts to develop his country and save its independent existence. The use of expressions such as "la capitale barbarica dei Negus" is merely ridiculous to those who knew Ethiopia before the war.

The description of Gondar states that research and restoration has been started on the magnificent ruins there. Any one who has visited Rhodes in recent years will agree that such work could not be in better hands. It is to be hoped that similar research will be undertaken on the monasteries and their libraries round Lake Tana. Much of the accounts of the larger cities (*e.g.* Addis Ababa, Gondar, Dire Dawa, and Harar) is devoted to the town-planning schemes that have been prepared. These are unquestionably a wise measure and appear to have been finely conceived. But it will of course be some years before there is much to show in this direction, particularly while the present economic chaos prevails. Little is said of present conditions. In all the principal towns streets have been renamed, so that it is difficult, if not impossible, for the old stager to locate himself without reference to a town plan. Before the Italian occupation, the hotel and restaurant industry throughout the country was almost entirely in Greek hands. It has now been taken over by two monopoly companies, and even the name of Bollolakos appears to have disappeared, except in connection with the Greek School at Dire Dawa.

The maps are numerous, well produced, and up to date, showing the remarkable amount of road construction that has been achieved. The type used for the letterpress, if small, is clear. In short, this is a most praiseworthy publication, and it is to be hoped that, as knowledge of the country improves and the passage of time permits a better historical perspective of recent events, its imperfections will be adjusted. E. H. M. C.

CENTRAL AND SOUTH AMERICA

GLORY DEAD. By ARTHUR CALDER-MARSHALL. *London: Michael Joseph*, 1939. 9 × 5¼ *inches;* 286 *pages; illustrations.* 15*s*

Mr. Calder-Marshall's book is designed to attract those who are unlikely to turn to blue books and reports of commissions for enlightenment on the present condition of Trinidad. During his six months on the island he came to know members of all classes—European, East Indian, and negro. The first part describes, through a chain of imaginary incidents, the daily life of Port of Spain, in a style which is certainly outspoken. The second describes his experiences of labour and social organizations, and of housing conditions and health services, both of which have been the subject of criticism in the past. The final part contains his suggestions for improvement, and general observations on the general problem of the colony. Though his style may displease some of his readers, his fundamental attitude is substantiated in general by other observers and by the findings of past commissions. Perhaps because much of his time was spent in the capital, his observations on the organizing of the export industries are limited to suggestions for improving the position of workers in the large-scale units, and he says little of the problem or the possibilities of establishing an independent agricultural community. He argues for a revision of the incidence of income tax, for the reduction of indirect taxation, the extension of the franchise, and for a broadcasting station to stimulate educational advance. His book is very readable; it would have been even better but for his determination to make his points as violently as possible. G. R. C.

AUSTRALASIA AND PACIFIC

UNCLIMBED NEW ZEALAND: Alpine travel in the Canterbury and Westland Ranges, Southern Alps. By JOHN PASCOE. *London: George Allen and Unwin*, 1939. 9½×6 *inches; 238 pages; illustrations and maps.* 16*s*

The book falls into two sections, one of which would make excellent papers for a climbing club or a local magazine where the personal touches would be appreciated. The other deals with the author's work, especially at the head of the Rakaia or the Rangitata, or is drawn from his great knowledge of what has been written about the New Zealand Alps. The English reader would have preferred more of this. One object of the book is to show that the Southern Alps are not merely the Mount Cook district but a chain 200 miles long, rising to its culmination in the magnificent peaks of Cook, Tasman, and Sefton. This central district was, and is still, the part that is most easily reached either by the tourist-haunted Hermitage on the east, or by the Franz Josef and Fox glaciers on the west. But the young New Zealand climbers have realized that a more attractive form of mountaineering lies to their hand: the climbing at the headwaters of the rivers near which they live. The only published maps, except of the Cook district, are very sketchy; the main peaks are fixed by trigonometric survey from the east or the west, but there are many problems still to be solved. The book is at its best in the chapters describing how a climber must be able not only to climb, but also to carry heavy swags to get to his climb, to ford a river and, if he is making a pass, to pick a line through the jungle-clad gorges of Westland and stick to it for a couple of days, when he will seldom see more than 20 yards ahead, and not 5 yards if he leads his party into really bad "bush." Nothing like this has appeared since Harper's 'Pioneer work in the New Zealand Alps,' 1896, and we ask for more. The work is being done, but the only records are in the excellent New Zealand Alpine Club *Journal*, or in the publications of the climbing clubs.

The photographs are excellent and well reproduced, though for the English reader there are too many groups. Curiously enough neither the speed of the film nor the film used are mentioned in the table of exposures on p. 217. The author is mistaken (p. 223) in thinking that there is a rule of the Alpine Club banning professionals; there is a long—and wise—tradition that no applicant should be elected who might use his membership to advertise his business or profession. H. E. N.

POLAR REGIONS

MY ESKIMO LIFE. By PAUL-EMILE VICTOR. Translated from the French by JOCELYN GODEFROI. *London: Hamish Hamilton*, 1938. 9×5½ *inches; 350 pages; illustrations and maps.* 12*s* 6*d*

The East Greenland Eskimo are less changed by European influence than any other group and they have many rare qualities which call out the respect and affection of everyone who knows them. Paul Victor's book is a vivid account of these people and it should give pleasure to the general reader for whom it is clearly intended. The author is a French ethnologist who led a small expedition which wintered in Angmagssalik in 1934–35. Having learnt the Eskimo language and something of the way in which they live, he returned by himself in 1936 and spent the greater part of a year with a small group of Eskimo at one of the more northerly wintering places. With heightened sensitiveness as a result of having no European companions, he learnt to know the East Greenlanders in a way in which few others have known them, except perhaps Knud Rasmussen.

Taken as a whole the book gives a credible and moving account of the Eskimo and of the author's relations to them. It is written in diary form and is rather disjointed. Irrelevant newspaper headings give facts unknown to the author when he was in Greenland, and there are many irritating and unnecessary footnotes, but these the reader may ignore. There are a number of minor inaccuracies (some perhaps due to translation) and some judgments which seem to the reviewer prejudiced; these tend to reduce the conviction which the book carries. Unless the Eskimo with whom the author wintered were exceptional, their interest in the supernatural and in dreams seems to have been overemphasized; and surely the author exaggerates when he states that in all matters relating to dogs, sleighs, and camps it is beyond dispute better to travel with Eskimo companions rather than with Europeans. Drawings of the Eskimo in various attitudes are excellent, and so are the photographs, but not the sketch-maps. L. R. W.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

DAS RELIEF DER ERDE: Versuch einer regionalen Morphologie der Erdoberfläche. By FRITZ MACHATSCHEK. I. Band. *Berlin: Borntraeger*, 1938. $10\frac{1}{2} \times 7$ *inches;* x+546 *pages; maps and profiles. M.*36

In the course of many years of lecturing Professor Machatschek realized that a comprehensive description of the "relief of the earth," with short summaries of the geological history of the various regions, was urgently needed. The present book is intended to provide this. Its first part (the only one published so far) deals with the continental blocks of Eurasia and with the Mediterranean mountain belt of the Old World. The author emphasizes that a vast number of publications had to be consulted and that the results given in a book of this kind can be based to a small degree only on personal acquaintance. He himself does not regard it as more than a first attempt to master the material. He is nevertheless to be congratulated on the large amount of information compiled, and although the chapters dealing with the respective regions are necessarily short (British Isles, for instance, 31 pages) they convey much of value to the reader who wants to learn something about the morphology of regions with which he is not well acquainted. A specialist, on the other hand, must not expect to find his district treated exhaustively. He will notice that, here and there, important facts are not mentioned or valuable publications omitted from the list.

The material is arranged in two geographical units, the solid blocks of Europe and Asia, and the Tertiary mountain chains ("Mediterranean mountain-belt"). In practice however the author has not strictly adhered to this division, and the mountain ranges of Central Asia, for instance, are treated after East Europe and Siberia and together with the continental blocks, obviously for reasons of convenience. A bibliography is given at the end of each chapter.

As a whole, geological history predominates over real morphology, and comparatively few actual descriptions of relief are found in this book. Yet there is no doubt that it is a very valuable addition to geographical literature and that, in future, it will frequently be consulted by workers on the history and evolution of the earth's surface. F. E. Z.

EARTHQUAKES AND OTHER EARTH MOVEMENTS. By JOHN MILNE. New edition (7th), revised and rewritten by A. W. LEE. *London: Kegan Paul, Trench, Trubner and Co.*, 1939. $9 \times 5\frac{1}{2}$ *inches;* xiv+244 *pages; illustrations and maps.* 10*s* 6*d*

Modern seismology owes its initial impetus and much of its earlier progress

to a geologist, Professor John Milne, who with a band of pioneers, including Ewing, Knott, and Perry, made a study of earthquake phenomena in Japan during the last quarter of the nineteenth century. Since the death of John Milne in 1913 seismology has continued to progress rapidly, and Milne's book, written in 1883 and appearing in six editions, together with a companion volume, 'Seismology,' in two editions, has to the regret of seismologists ceased to be an informative work. Yet no treatise has appeared in this country to supersede it, and it is most felicitous that Dr. Lee, with his experience of practical and theoretical seismology, should have rewritten this work: for the subject has needed such a completely new review that for all practical purposes this must be regarded in every way as a new book rather than a new edition.

Dr. Lee has achieved a remarkably well-balanced exposition of a subject that has many contacts with other branches of knowledge, for he could easily have wandered off into some of the fascinating bypaths that call for exploration. His discrimination in what he has omitted is as praiseworthy as the number of different aspects that he has presented. There is plenty to interest the geographer and the geologist, and in this respect Lee has paid a great tribute to the memory of Milne. The visible phenomena of earthquakes call for a fair share of attention, and the earlier chapters, which also include one on "Earthquakes and construction," are interesting to read and are very fully illustrated by photographs of earthquake damage.

The chapter on seismographs sets out clearly the principles and types used, and is adequate without being too compendious. Much information is presented in the chapters on earthquake records, but the reader is not bewildered with unessential details, and is given a good idea of the information that has been obtained from seismograms concerning the interior of the earth. The existence in the earth of a core of high density and low or zero rigidity, and likewise the radius of this core, have been ascertained from a study of seismograms. Some information is forthcoming about the structure of continents, but much remains to be done; as in other sciences, the solution of one problem raises more problems to be tackled. The existence of "deep-focus" earthquakes with foci 600 kilometres deep was first discovered by H. H. Turner and has presented geologists and geophysicists with a problem that they have not yet solved.

It is, of course, well known that there are belts of great seismic activity, notably in Japan. It is an interesting discovery that the deep-focus earthquakes in Japan occur in two belts, which cut across, more or less at right angles, the main trend-line of volcanoes and shallow-focus earthquakes. Some progress has been made in elucidating the nature of the dislocation that gives rise to earthquake waves, but there is still much to learn. Dr. Lee's later chapters summarize most of what can usefully be said at the present time on the origin of earthquakes.

The book concludes with a chapter on seismic methods of geophysical prospecting; this work is of direct seismological interest, and quite apart from its commercial importance it is yielding results of great geographical interest, particularly in investigating the nature of the continental shelf of the United States and, just recently, of Europe. R. S.

METEOROLOGIA PRATICA SUPERIORE. By FILIPPO EREDIA. (Scuola di Guerra Aerea. Corsi normali.) [*Roma*]: *Ministero dell' Aeronautica*, 1938. 12 × 8½ *inches; 196 pages; maps and diagrams*

This is an excellent treatise on meteorology designed chiefly for aeronautical students. It contains numerous charts illustrating in some detail types and peculiarities of weather over Europe with special reference to the Mediterranean,

and includes a discussion of technical subjects like the structure of depressions according to modern theory, the vertical lapse rate of temperature as bearing on thunderstorm genesis, and ice formation on aeroplanes. There is an interesting account of wind, cloud, and precipitation in Italy, and a table on p. 174 relating to thunderstorms brings out a conspicuous summer maximum and winter minimum in the northern provinces typical of Central Europe, and a more even seasonal distribution with definite autumn maximum in the south including Sicily and Sardinia.

Diagrams on pp. 79–81 show the effect of mountains in obstructing the passage of air currents and "fronts," but it would seem that they rest rather on a reasonable assumption as to how the air masses would be expected to move in such circumstances than on proof that they actually would so behave. On p. 40 classification of the different forms of cloud in relation to altitude might be made a little clearer. In English works it is customary to divide the clouds primarily into "sheet" clouds and "heap" clouds; the former are then subdivided into upper, middle, and lower, whilst the latter are left outside this altitudinal arrangement, since cumulus clouds have a wide vertical range. Thus a mountainous cumulo-nimbus may, as Professor Eredia indicates, have a base as low as 400 metres and a summit reaching nearly to the cirrus level, that is, may be some 4 miles deep. The statement on p. 160 that in winter the normal deepening of the Icelandic low-pressure system is associated with intensification of the Azores high-pressure system is inaccurate. Actually the latter is weaker and less extensive than in summer, but pressure is higher over the European continent and this steepens the barometric gradient for south-west winds across the British Isles. L. C. W. B.

FOURTH INTERNATIONAL GRASSLAND CONGRESS. Great Britain, 1937. Report, containing full texts of all papers delivered to the Congress at Aberystwyth, July 1937. Edited . . . by R. O. WHYTE. *Aberystwyth*, 1937. $9^{1}/_{2} \times 7$ *inches;* xxxiv+486 *pages; illustrations and sketch-maps.* £2

Delegates from thirty-seven different countries attended the Congress, and in his presidential address Sir R. George Stapledon emphasized the part that grassland must play in the adequate feeding of the peoples of the world with fresh food of the highest quality and balanced in every respect. The other papers covered all aspects of grassland science: plant breeding, the testing of strains of plants and the compounding of seed mixtures suitable for different purposes, grazing technique, and manuring being amongst the topics dealt with. From the geographer's point of view however two aspects of the report stand out: the wide range of soil and climatic conditions over which grassland farming is practised and the new uses to which grassland has been put during this century. Though grassland has usually been associated with wet climate and retentive soils, as in Britain and Northern Europe, it is surprising how its importance is extending to less favoured areas all over the globe. This is due to the spirit of adventure found amongst agriculturists, combined with successful scientific research.

Of the six sections into which the papers were grouped, one is devoted to the study of grassland from the ecological point of view. The moisture supply being the most important factor, the majority of the papers deal with methods of making the best use of what moisture there is under the semi-arid conditions typical of vast areas in South Africa, the United States, and South America, all of which have during the past century supplied much of our meat and wool at the expense of depleting their grassland resources. The papers contributed to this section from Britain however trace the changes (under a

plentiful rainfall) that have occurred in the grassland flora through the movements of man and his grazing animals, the ecological types changing with economic conditions and with interference such as treading, whilst the present flora gives a clue to the past history of the land itself.

Amongst the modern uses of grassland pride of place goes to holding or conserving land in face of the great scale of soil erosion prevailing in recent times, particularly in the United States, where it has been found that a proper cover of grass over the land, with the accompanying root development in the soil itself, is its best protector. Apart from drought the chief factor to contend with in grassland is lack of growth. New methods of conservation of young grass, as artificially dried grass or as grass ensilage, have however made it possible for the surplus growth at any one time to be preserved as a highly nutritious feed, so that nowadays the animals can be catered for all the year round on grass alone in districts which previously had either to import artificial feeding-stuffs or else resort to arable crops. All these developments exert an incalculable influence on the commercial possibilities of not only countries but continents, inducing a flow of population from one part of the globe to another and thus eventually deciding in a large measure the destiny of nations. M. J.

CARTOGRAPHY

A DESCRIPTIVE LIST OF THE PRINTED MAPS OF LANCASHIRE, 1577–1900. By HAROLD WHITAKER. *Manchester: University Press, for the Chetham Society*, 1938. $8\frac{1}{2} \times 6\frac{1}{2}$ *inches;* xvi+248 *pages; facsimile maps.* 15*s*

Mr. Harold Whitaker, who some five years ago brought out an excellent catalogue of all the maps of Yorkshire traceable by him down to 1900, has followed this up with an equally careful list of Lancashire maps, this county not having been dealt with before with anything like the same completeness. The new volume conforms closely with the Yorkshire one in plan and arrangement, even to the type used, one minor improvement being however the greater prominence given to the running numbers of the separate maps. As before, the arrangement throughout is chronological, perhaps the most satisfactory on the whole, though it means that the successive issues of the same map may be widely separated. But all are noted under the first entry, and are grouped together in the comprehensive table at the end. Undated maps have perforce to be entered under the year regarded as most probable, and the grounds for the assignation are not always made clear.

There is necessarily a good deal of sameness in all such catalogues, which must primarily interest residents in the counties or collectors of relevant maps. For their help, Mr. Whitaker gives very careful notes of the small details distinguishing each issue of the same map. To those interested rather in the general evolution of British cartography there is also a good deal that appeals, especially with regard to the bibliographical history of the earlier efforts. Through the recent acquisition by the British Museum of the first complete set of the "Playing-card" maps of 1590 it has been possible to include the Lancashire from this, and to give a facsimile. The successive issues of the "Thumbnail" maps based on these are carefully dealt with, and the probability noted that there must have been an original issue before 1635, though Mr. Whitaker does not refer to the suggestion made in the *Journal* that it may have been a venture of Hans Woutneel. To the names noted of booksellers for whom the 1637 edition of Camden was printed, two more might be added, those of George Latham and William Aspley: it seems that a separate title-page was used by each member of the combination—a rather unusual occurrence. Of re-issues of

Saxton's maps, Mr. Whitaker supports the idea that one was in preparation in 1665, but that either the plague or the fire of London may have put a stop to the project. An interesting discovery is that of a re-issue by Jefferys so late as 1749, a fact not generally known.

As regards re-issues of Speed's maps, some might question their attribution to the dates at which the 'Prospect' rather than the 'Theatre' was reprinted. Although the two were generally sold together, they were separately paged, and old stock of the 'Theatre' may quite possibly have been combined with the reprint of the other. Mr. Whitaker seems to imply that the maps in the Camden of 1595 were the first county maps to use the meridian of London. The innovation had been made by Seller however some years earlier in one or two of his maps.

Of the host of later maps many have no claim to originality, and of those on a higher level few are peculiar to Lancashire; like Bowen's of 1752 they belong to general county atlases. Yates' map of 1786 however stands on a different footing, being the first map of Lancashire on a really large scale. It was shortly followed by Cary's excellent maps, while in 1818 the fine map of Greenwood foreshadowed the 1-inch maps of the Ordnance Survey.

Mr. Whitaker has carried out his somewhat tedious task with very great thoroughness, and the volume is well printed and illustrated by facsimiles of old maps. E. H.

TABULA IMPERII ROMANI. Map of the Roman Empire based on the Carte Internationale du Monde au millionième. Sheet L 31, Lugdunum. *Paris: Service Géographique de l'Armée*, [1938]. 17½×19 *inches*. 20*fr*.

The great project of the Tabula Imperii Romani, the map of the Roman Empire on a scale of 1/M, is progressing, albeit slowly, and the latest sheet is a welcome addition to it. Scholars are perhaps apt to be a little impatient at the delays, but those who have had experience of the long and tedious process of making an exact and detailed map, with all the difficulties of printing and of superimposed colouring, can understand and sympathize with the reasons for them. This map is also welcome as the first to be drawn in the new style and with the new conventional signs agreed on by the international Congress upon the Map of the Roman Empire which met in London in 1935. The work of coordination is undertaken by a small permanent Council, consisting of O. G. S. Crawford (Secretary), G. Bersu, G. Lugli, and H. Seyrig. Each country however is responsible for the maps of its own territory.

There can be little but praise for this sheet. The reviewer does not know this section of the country well from personal observation, but in working over it he has not discovered any mistakes or misprints. Two omissions however may be noted, as they can easily be rectified in subsequent editions or maps. The first is that the sheet number, 31, does not appear anywhere on the map, though the title of the sheet, Lugdunum, is clearly given. The second concerns the list of conventional signs printed at the bottom of the map. The reader will find a number of sites, as *e.g.* near Fontenoy, marked with the conventional sign for a mine (two crossed picks) with the abbreviation '*Fe*' after it, but he will search in vain for the meaning of this abbreviation on the list, though it is not difficult to conjecture that it stands for *Ferrariae*. One other small criticism concerns the printing of tribe-names on the dark-tinted portions that indicate high ground; they are sometimes very difficult to discover; and it is, for instance, not easy to pick out the name of the Arverni. This difficulty might be overcome by obliterating the detail under the actual letters. But all these points are small and quickly remediable. For the rest a study of this map shows very clearly the

number of the roads, the mineral wealth of the country, and the extent of the population. M. P. C.

ECONOMIC AND HISTORICAL GEOGRAPHY

RASSENKUNDE UND RASSENGESCHICHTE DER MENSCHHEIT. By EGON FREIHERR VON EICKSTEDT. Bd. I. Die Forschung am Menschen. Lieferungen 1–4. *Stuttgart: Ferdinand Enke*, 1937–38 (*second edition*). 10½×7 *inches; 496 pages; illustrations and maps. M.*8; 8; 6.60; and 10.80

According to the title-page of this new edition it has been thoroughly rewritten; as far as can be judged it would be almost truer to say that an entirely new book has been produced. It will eventually consist of two volumes. All that has at present appeared runs to nearly five hundred pages and consists of an historical introduction and a summary of the methods in use by anthropologists, but even these are not quite completed: there is very little doubt that it will eventually be a monument to German learning.

On actual racial questions the parts issued confine themselves to a general summary. The author is concerned with the development of anthropological learning, and the contribution of various individual anthropologists, with a most interesting series of photographs. Secondly he deals with the scope of the science and its limits, and thirdly with an exposition of the actual and statistical methods generally in use to-day. Dr. von Eickstedt is well known both for his photography and for his synthesis of his own and other people's work into a general conspectus of the divisions of the human race. He has now in general terms (the details will no doubt come into later parts) divided the whole of mankind into subspecies, series, and varieties. A recent paper in *Biometrika* has shown that, tested by the methods in use by the Biometric school, his ideas appear to be the best exposition which has so far appeared of racial grouping in America. Until however we have more of the work it would be unfair to offer serious criticism. The present reviewer feels that the history of a science can best be discussed not so much by an active worker in the science as by a trained historian. When the author gets on to his own subject his exposition is very clear. In so vast a work mention might well be made of summation methods in calculating the parameters of curves, but possibly this may come in later. Generally speaking however there can be little doubt that in its new and encyclopaedic form the book is a complete summary of anthropological method which will give the student a conspectus of the whole subject. As far as can be judged the ethnological side is of a wider nature and will attempt seriously to classify the physical characters of mankind. L. H. D. B.

THE SECOND VOYAGE OF CHRISTOPHER COLUMBUS FROM Cadiz to Hispaniola and the discovery of the Lesser Antilles. By S. E. MORISON. *Oxford: Clarendon Press*, 1939. 7½×5 *inches; 112 pages; maps.* 6*s*

Professor Morison examines the route through the Lesser Antilles followed by Columbus on his second voyage from the point of view of an experienced yachtsman familiar with those waters. From his personal experience and a study of the original sources he has identified the features named by the discoverer. His main contention is that Columbus sailed by preference along the lee shores of the islands, and he condemns previous commentators for placing his route to the north of the Virgin Islands and Puerto Rico. He admits in another context however that Columbus on occasion sailed on the windward side of an island, and he is perhaps unnecessarily severe on some of his predecessors in this study. His interpretation of the available evidence appears very reasonable,

and it is useful to have these identifications established. Like many other students he seems undecided as to whether or no Columbus himself was a skilled navigator. The essay is briskly written, and the maps are clear.

G. R. C.

DIE STRASSEN DER WELT: eine Strassengeographie. By KARL KRÜGER. *Berlin: Volk und Reich Verlag*, 1937. 9×6½ *inches;* 152 *pages; illustrations and maps*

The road, in its various forms, has for centuries played a vital part in man's activities in most parts of the world, and yet geographical literature relating to roads is scanty and scattered. The reason advanced by Dr. Krüger is that geographers have not the technical knowledge required to write about road construction, whilst road engineers are generally ignorant of the geographical aspect of their work. On the whole Dr. Krüger may be said to combine the engineer and the geographer, though the geographical part of his work is mainly descriptive. After dealing with economic and aesthetic aspects of road building, he outlines the technical problems involved in the construction and maintenance of modern motor roads, such as the German *Autobahnen* and their equivalents in the United States and elsewhere. There are some excellent photographs of German and American motorways in construction and completed. He outlines the main natural obstacles to road construction, and then proceeds to give brief descriptions of the present road system, and its possible future development, in the principal countries of the world. Numerous maps accompany this section, giving a clear picture of the distribution of motor highways. "England," he says, "is romantic and conservative." It has many roads, with many curves and many hedges, as a legacy from the past, but the two characteristics mentioned, together with a clumsy administration, make improvements difficult to carry out. Widening, re-grading, and by-passing have been done on a small scale, but not until 1936 was a system of modern motor highways planned.

Dr. Krüger is mainly interested in the modern motor road regarded as an expression of the machine age. He is not concerned with the whole road system of the countries with which he deals, and in consequence the impression he leaves is inevitably incomplete. He regards Germany as the home of the *Autobahn*, and indicates that other European countries, and the United States, have adopted the German ideas and technique. He is interested, too, in the aesthetic value of beautiful roads, which he regards as promoting *Kultur* and as contributing to racial pride. Strategy is not neglected, and he points out how Germany lies at the crux of two great European routeways, from the Channel to the Bosporus and from the Mediterranean to the Baltic, a situation which will help the spread of German ideas.

There is much that is interesting and valuable in this book, but one gets a little tired of the frequently irrelevant praise of things German. S. H. B.

FIGURES DE SAVANTS. Tomes III et IV. L'Académie des Sciences et l'étude de la France d'Outre-Mer de la fin du XVII^{e} siècle au début du XIX^{e}. By ALFRED LACROIX. *Paris: Gauthier-Villars*, 1938. 10×6½ *inches;* xiv+220 *and* 260 *pages; illustrations.* 125*fr.;* 150*fr.*

M. Lacroix has rescued from oblivion the life histories of a number of pioneers of scientific research in the French colonies, many of whom were more or less connected with the Académie des Sciences. He is concerned with a period from the end of the seventeenth century to the beginning of the nineteenth, when scientific research was largely limited to astronomy and botany, and was carried out by doctors and missionaries, whose scattered achievements have been over-

shadowed by the exploits of those who actually created the colonial empire. The biographies are arranged in chronological order, in three regional groups: Antilles and Guyane; Mascareignes, Madagascar, Indes; and Afrique Occidentale. Set out in this way the two volumes should form a valuable source of information on the exploration and development of the French colonial empire.

GENERAL

GEOGRAPHIC ASPECTS OF INTERNATIONAL RELATIONS. [Lectures on the Harris Foundation, 1937.] Edited by CHARLES C. COLBY. *Chicago, Illinois: University of Chicago Press—London: Cambridge University Press*, 1938. $7\frac{1}{2} \times 5$ *inches;* xii + 296 *pages; maps.* 13*s* 6*d*

The lectures here printed cover some very diverse topics; they tend to be discursive and are on occasion contradictory, especially on the question of "natural boundaries"; yet they are linked together by mutual apprehension over the diminishing influence of geographical factors in world planning, and the possible consequences of apportioning world resources among a series of rigidly state-controlled nationalist units. The far-reaching effects of state intervention in world economy are dealt with by M. Denis; in internal reconstruction Professor Barrows, discussing water problems in the United States, demands a federal plan to prevent inter-state dissipation of resources. Dr. Bowman develops as his theme the essentially predatory nature of all colonization; a convenient theory which, in his study of "four hundred years of western colonization from European spawning grounds," seems to have led him to overlook other aspects of human nature. There is, he concludes, no further outlet for surplus population in colonies, and those nations which possess them find their former assets turned to liabilities. How this may come about is suggested by Professor Whittesley who, in one of the best of these papers, describes the results in West Africa of the north-south pattern imposed by political rivalry on a region whose zones run east and west. Professor Hartshorne deals with boundaries in Europe. His attempt to classify boundary disputes introduces a subjective element, redeemed by common-sense comments on individual cases; he emphatically denies the existence of "natural frontiers" in Europe to-day. The last two papers deal with population problems in South America: Professor James describes population distribution, and Professor Platt gives details of the conflicting claims of Brazil, Peru, Colombia, and Ecuador on the upper Amazon, where east- and west-flowing currents of settlement meet. Professor Platt concludes that nation-states are less fundamental and less permanent phenomena than the grouping of people in the regions to which they belong. These last two papers are accompanied by four useful distribution maps of South America (population, surface configuration, vegetation, and occupance) on a scale of approximately 300 miles to 1 inch, the compilation of which is discussed by Professor James. J. P. H. M.

ORIENTAL TRAIL: a journey from Port Said to San Francisco. By RICHARD CURLE. *London: Duckworth*, 1938. $7\frac{1}{2} \times 5$ *inches;* 190 *pages.* 6*s*

For round-the-world travellers, who, for one reason or another, are seldom able to leave the beaten track, Mr. Curle's account of a journey from Port Said to San Francisco will be welcome. Within his tour lay Ceylon, the Malay States, the Dutch East Indies, the Philippines, Macao, Tokyo, and Hawaii. The style of the book is concise and pleasant. The author lays claim to no adventures, but his taste is catholic and his observations not without interest.

THE MONTHLY RECORD

MEDALS AND AWARDS 1939

His Majesty the King has approved the award of the Royal Medals as follows: the *Founder's Medal* to Mr. Arthur Mortimer Champion, for his surveys of the Turkana Province and the volcanoes south of Lake Rudolf; and the *Patron's Medal* to Professor Hans Ahlmann of Stockholm, for his exploration and glaciological studies in the Arctic. The Council have awarded the *Murchison Grant* to Mr. Robert Bentham, for his mapping and geological investigations in Ellesmere Land; the *Back Grant* to Lieutenant-Commander R. E. D. Ryder, R.N., for his captaincy of the *Penola* and his marine surveys on the British Graham Land Expedition; the *Cuthbert Peek Grant* to Mr. W. Vaughan Lewis, for his physiological studies in Great Britain and Iceland; and the *Gill Memorial* to Mr. J. V. Harrison, for many years' exploration in Central and South America and Southern Iran.

GLASS-MAKING IN BOHEMIA AND BAVARIA

In a monograph entitled "Das ostbayerische Grenzegebirge als Standraum der Glasindustrie" (*Mitt. geogr. Ges. München*, Bd. XXXI, 1938) Dr. Dirscherl has published his researches into the historical geography of glass-making, localized since medieval times in the Bohemian and Bavarian forests. This district contains several small glass factories, and is dotted with the ruins of many more, suggesting that many settlements originated with the spread of the industry. The abundance of the two principal raw materials engendered a rapid growth of glass-making in the fourteenth and fifteenth centuries. Quartz occurs both along the great fault of the Pfahl, and in the Bohemian Forest region generally. Timber was to be had in abundance, for firing furnaces and for destructive burning in order to obtain, by the primitive method then in vogue, the essential flux—potash. Limestone and fireclay for the crucibles was brought from the Danube near Regensburg, generally by sledge in winter. The chemicals needed for colouring could be readily obtained at Nürnberg. Thus all materials required were available either locally or from places near by; and this combination of favouring factors enabled the industry to flourish down to recent times, while glassworks in the rest of Bavaria became derelict through failure of their timber supplies, or the difficulty of obtaining other requisites. Nevertheless as time went on the once seemingly inexhaustible forests became manifestly depleted, and, towards the end of the eighteenth century and the beginning of the nineteenth, numerous works closed down or migrated. Timber prices started to rise, and the State began to buy estates attached to glassworks for the purposes of rational forestry. But the industry was saved for a time by the substitution of Glauber's salt for potash (as well as by the replacement of forest-produced potash by the product of Stassfurt mines); by the adoption of Siemens gas furnaces, which halved fuel costs; and by the improvement of roads, which enabled glass masters to draw supplies of thinned saplings and trash from a considerable area. In fact, after the 'thirties of last century the increasing foreign demand, especially in U.S.A., allowed existing factories to continue earning profits, and even permitted the establishment of new works. But in the 'seventies the position changed radically. Railway communications branched off from the main lines along the Danube; and extended gradually into the hills till contact was effected with the Bohemian network. This facilitated the substitution of coal for wood as fuel, since the former could now be cheaply conveyed from Pilsen. The final phase of the industry had begun. Works situated at a distance from the railway lines were

forced to close down, and among these were several that had been owned and operated over a period of several centuries by successive generations of a single family. By this process, and by the founding of several new factories in the old towns along the railways, a relocation of glass-making within the region ensued. Glass-making has ceased in remoter forested hills; the market towns of the valleys—Frauenau, Furth, and Neustadt—which formerly had little to do with manufacture, have become both railway junctions and small manufacturing towns. The capital needed for this change was provided by the merchants, chiefly Jewish, who had controlled and developed the export trade in glass during the mid-nineteenth century. But this phase was short-lived. The invention of glass-making machinery, the growth of the industry in U.S.A., and the utilization of quartz sands from Lausitz as raw material have favoured the establishment of new and much larger works on coal-fields, thus dealing a mortal blow to Bavarian glassworks. They, with the exception of less than a dozen small factories, have not survived the war and the trade depression. A district which offered a peculiarly favourable environment to an industry in a former age, now offers nothing, and it seems that a long chapter of Bavarian industrial history is about to close. The alienation of glass-making from its original home (*Bodenentfremdung*) is practically completed. J. H. G. L.

SAXTON'S LARGE MAP OF ENGLAND

We are pleased to learn that, thanks largely to the liberal help of Alderman W. A. Cadbury, the copy of Saxton's large map which turned up a couple of years ago at the Clumber sale has been secured for the Birmingham Public Library, where it is now on view. It will therefore be more accessible to the interested student than if buried, so to speak, in a private collection. It will be recalled that a copy of the map, the twenty sheets bound together in atlas form, was acquired by the British Museum some ten years ago, this being the only copy so far brought to light in its original state, before being altered by Lea in the seventeenth century. Even so, some doubts were felt as to whether it was not an impression somewhat later than the original publication in 1583, the date which it still bore, for the paper showed a watermark found otherwise only in the mid-seventeenth century, though there were no indications that any change had been made in the plate. The Birmingham copy is mounted on canvas so as to show the complete map in one view, and though the condition is not all that could be wished, the artistic excellence of the map is thus brought out much better than when only one sheet can be inspected at a time. Another difference from the British Museum copy is the possession of an ornamental border exhibiting the coats of arms of prominent persons, such as were given in the County Atlas collected in a sheet preceding the maps. This brings it still nearer the state in which it must have left the publisher's hands, and this conclusion is supported by the watermark, which Mr. Cashmore, the Birmingham Librarian, has succeeded in identifying under a strong light, despite the coarse canvas on which the map is mounted. It is the bunch of grapes which with slight variations is most commonly to be seen in the early issues of the Atlas.

E. H.

LAND UTILIZATION IN CHINA

Our attention has been kindly called to a misprint in the review of 'Land utilization in China' by J. L. Buck in the March *Journal*. On p. 248, on lines 19 and 21, "north" and "south" should be interchanged. It has also been pointed out that while it is true that pedocals predominate generally in the arid north, the soils of the damper parts, such as the mountainous parts of Shantung, are actually slightly podzolic brown soils, and thus belong to Marbut's pedalfers.

LOWER YANGTZE TERRACES

In connection with the paper on the lower Yangtze terraces which appeared in the *Journal* for January 1939, we are informed that the complete field data have now been published by Mr. Hanson-Lowe in the *Bulletin* of the Geological Society of China (18 (1938) 75–114).

THE GREAT BARRIER REEFS

In two recent papers (*Journ. and Proc. Roy. Soc. N.S.W.*, vol. 71, pp. 68–85, and *Reports* of the Great Barrier Reef Committee, vol. 4, pt. iii), Professor H. C. Richards has given a general review of scientific work, and results obtained, on the Barrier Reefs, and also a preliminary account of the recent bore put down on Heron Island.

The scientific world owes a great deal to Professor Richards, who is now Chairman of the Barrier Reef Committee. It is very largely through his influence and energy that all recent work on the reefs has been accomplished. In the first of these two papers he reviews generally the nature of this work and considers the possibility of adopting seismic sounding methods to obtain the depth of the, presumably, solid floor on which the coral and incoherent material rests. In the writer's view Richards and his Committee were fully justified in insisting on the Heron Island bore before attempting seismic methods. He remarks: "Pendulum gravity surveys, unfortunately, are not likely to be useful in telling us the thickness of the coralline material, because the results of the two deep bores (*i.e.* Michaelmas Cay and Heron Island) do not indicate a sufficient difference in density between the overlying coralline sand material and the underlying siliceous foraminiferal sand. Whether they would tell us the depth of the underlying platform is another matter, but we have not yet been able to ascertain a means of doing that satisfactorily."

It is a noteworthy fact that the main results of the two bores, put down in places so far apart, are almost identical. In the Michaelmas Cay bore about 427 feet of coralline material were passed through, most of it loosely coherent except for about 11 feet of harder stuff. From 427 feet to 600 feet there were found loosely coherent quartz sands, in parts glauconitic and with foraminifera and littoral shell fragments: there was no hard cementing material. Incidentally, the coralline material was not dolomitized. The Heron Island bore reached 732 feet. From the surface to about 450 feet all the material, except 2 feet (292–294 feet) of silica sand, was coralline with many algal and foraminiferal remains. This was followed, below *c.* 450 feet, by "non-coralline material in the nature of loosely coherent quartz sand with abundant foraminifera and littoral shell fragments . . ." Again, there is no dolomitization of the coralline material—at least, as far as preliminary tests go. For further details, *i.e.* the occasional occurrences of thin siliceous foraminiferal limestone sands, etc., reference should be made to the chart of the bore given in the second paper.

In a short historical summary in the first paper, reference is made to Beete Jukes' work when he was naturalist aboard H.M.S. *Fly*. Any one who knows the reefs will agree that despite what has been done since 1843, Jukes' account is probably the most interesting ever written on this gigantic mass of reefs.

J. A. S.

WIRELESS FOR EXPEDITIONS

In the January number of the *Polar Record* there appeared a much-needed article on wireless equipment for expeditions. Nearly every expedition in these days takes some form of wireless, even if it be only a miniature receiver for time-signals. Unfortunately in a large number of cases the results have been far from

satisfactory, and much unnecessary anxiety has been caused through the failure of transmission sets, due either to incompetence on the part of the operators, or to the unsuitability of the apparatus, or more generally to a combination of both. Not a little of the trouble has resulted from the lack of suitable literature on the subject, and one hopes that Captain Meiklejohn's excellent article will give a lead to the publication of further information on expedition wireless.

Generally speaking, unless required for research purposes, extensive wireless equipment is liable to be more of an encumbrance than an asset to an expedition, and should be strongly discouraged. It is, for instance, hard to see how anything beyond a time-signal receiver could possibly be justified on a long sledging journey, where additional food and warmth are far more likely to be of use in an emergency than a call for help with a doubtful transmitter. Base transmitters for sending press news should be avoided at all costs unless managed by an expert capable of effecting all repairs, and properly versed in morse technique.

In connection with sets for intercommunication between camps it is worth mentioning that the Oxford University Expedition to West Greenland last year took out three portable radio-telephony sets of German Army pattern, lent by Messrs. Telefunken of Berlin, and working on wave-lengths 4700–6300 kilocycles (50–60 metres approximately). Each apparatus, complete with sectional aerial and two dry batteries (high and low voltage), weighed only 60 lb., and fitted into a compact rigid metal case adapted for carrying on the back. These sets had advantages that commend them to other expeditions. They stood up to any amount of rough usage (including being immersed in salt water) without ever giving trouble; they could be worked easily and efficiently by untrained amateurs; regular communication by telephony as well as morse was established with them between camps 8 miles apart, between which there was no optical path (necessary for ultra-short wave-lengths). Using telephony only, the transmitting range of these instruments would be about 15–20 miles, and at least double that for morse. In addition to short-range reception European news was clearly received on the ice-cap.

A problem not mentioned in Captain Meiklejohn's report, and which seems to be the subject of considerable differences of opinion among experts, is the disturbing influence of aurora on wireless waves. It would be valuable to have on record the opinions and experiences of those who have made a study of these phenomena. P. G. M.

ADDITION AND SUBTRACTION LOGARITHMS

Nowadays the best field method of obtaining latitude and longitude with a theodolite is the quadrantal and intercept method. This involves calculating an altitude and azimuth for each star observed, a somewhat tedious process by the usual formulae adopted for logarithmic computation. For observers requiring an accuracy sufficient for navigation purposes there are various tables for shortening the calculation, but none of these are suitable for field astronomy. To supply this need a new edition of Cohn's 'Tables of addition and subtraction logarithms' has been published by the Scientific Computing Service, Ltd. (price 10*s*), largely for use with this Society's Form No. 7. The purpose of these tables is to obtain the logarithm of the sum or difference of two numbers that are known by their logarithms only, and this they do with one table entry as against three required for ordinary logarithms. For ease in use it is well to have an arrangement of the calculations showing the order of working and procedure in all cases; this is given in the preface and, in a simplified manner, on R.G.S. Form No. 7. G. C. F.

ADMIRALTY WEATHER MANUAL

The 'Admiralty Weather Manual 1938' is the first issue of a new publication on meteorology, between a text-book and an encyclopaedia in character, which should prove a valuable work of reference [Published for Hydrographic Department of the Admiralty by H.M. Stationery Office, 1938, at 10*s* 6*d* net]. Section I is an account of meteorological observations and instruments in great detail, special attention being given to practice on H.M. ships; Section II embraces the general principles of meteorology, including a description of local winds characteristic of various seas; and Section III deals with synoptic meteorology and the issue of weather forecasts. In spite of the large amount of technical matter, including an elaborate explanation of the telegraphic codes in use, the work is very readable and is illustrated by excellent cloud photographs and by clearly produced charts. The Manual is no mere reproduction of already published work, for a good deal of new material appears to be embodied in the descriptions of clouds, depressions and other phenomena. The classification of thunderstorms into "heat" and "frontal" no doubt accords with current teaching, but the soundness of the distinction may well be doubted.

LOCAL CLIMATOLOGY

It is symptomatic of the rapid progress of local climatological study that, within seven years of the appearance of the first text-book on local climatology,[1] there should be room for an admirable monograph on urban climates alone: 'Das Stadtklima,' by Albert Kratzer ('Die Wissenschaft,' Bd. 90, 1937). The text provides at once a thorough, rational exposition of the factors endowing the city climate with individuality and a convincing demonstration of the reality of city climates; while its bibliography of two hundred and fifty entries is both an invaluable guide to future workers and an ample justification of the author's enterprise in surveying the field.

Emphasis is placed on the interference of buildings with air movement, the influence of dust on incoming and outgoing radiation, the heat receipt from combustion, and the tendency for the predominantly dry, heat-absorbing surfaces to become heated by day at a greater rate than the open countryside, and to cool more slowly by night. As a result of the foregoing factors it is shown that there are small but significant differences between the mean monthly and mean annual temperatures of city and country—the characteristic feature here is that the city is the warmer by 1–1½° C. More striking are the data for the occurrence of definite temperature conditions; thus Berlin has 33 fewer frost days than Berlin-Blankenburg, while Munich has 61 days more than Munich Botanic Garden frost-free.

The greatest possible interest attaches to the author's presentation of the result of surveys of cities made under specific weather conditions. The reviewer summarized the findings of several of these surveys in *Geography* (22 (1937) 87–100), and the present work confirms the main points. As in all local climates strong departure from the macroclimate develops in the climates of cities in calm cloudless weather. In these circumstances the city may be warmer by some 10° C. than the open countryside at 2 p.m., and still warmer by 5° C. by 5 a.m. the next morning. Such figures cannot be ignored, and the fact that such large numbers of mankind live in towns justifies much more research into their real climates. Even in this country, where clear calm weather is not of long duration, it has been shown that quite startling discrepancies between town and

[1] Geiger, R., 'Mikroklima und Planzenklima' (W. Koppen and R. Geiger, 'Handbuch der Klimatologie,' Bd. I, Teil D), Berlin, 1930.

country stations emerge.[1] Significant individuality in humidity, cloud amount, and fog is established, but one is much less impressed by the author's attempt to demonstrate a possibly greater precipitation over urban areas; rainfall is a touchy thing to handle where so many disturbing factors are concerned.

All students of climatology are indebted to the author for this concise, workmanlike monograph in a pioneer field. H. A. M.

OBITUARY

Dr. A. DONALDSON SMITH

Dr. A. Donaldson Smith, who died in Philadelphia on February 18, had been a keen traveller in many parts of the world, but it was not until 1893 that he was introduced to Africa by Dr. William Lord Smith, of Massachusetts, when he accompanied the latter on his hunting expedition in Somaliland. It was then that Dr. Donaldson Smith conceived the idea of travelling through the unknown Galla country east of Lake Rudolf. In spite of considerable opposition and pessimism on the part of his friends he persisted with the project, first preparing himself for taking efficient scientific observations by undergoing instruction from Mr. J. Coles of this Society in survey, and from the British Museum in the collection of natural history specimens.

He left London on 1 June 1894, to return one and a half years later after travelling from Berbera through the Ogaden and Boran districts to Lakes Abaya and Stefanie in the Abyssinian rift valley. Finally he became the first European to reach Lake Rudolf after its discovery by Count Teleki and Lieut. von Höhnel. An account of that journey is given in his book 'Through unknown African countries.' In 1899 he returned to the same country and continued his exploration by crossing the Omo and traversing the region between that river and the Nile. This second journey was described by him in a paper given to the Society in 1900, and in 1901 he received the Patron's Medal of this Society and the Elisha Kent Kane Medal of the Philadelphia Geographical Society.

In view of his two fine journeys and the excellent observations of which he proved himself capable, it was a pity that he was unable to continue his African travels in later years.

MEETINGS: SESSION 1938–39

Eleventh Evening Meeting, 3 April 1939. Professor Kenneth Mason, Vice-President, in the Chair

Elections: William Harley Brindley, M.C., M.A., F.R.S.A.; Lawrence John De Martino, M.B.E.; Scott Hale; Adrian Justly Hill; Captain P. M. Hill; H. C. Janes; Shaun McCurtin, M.A.; Mrs. Grace Ogilvie; Christopher John Lees-Smith; Reverend William Ernest Tilley; Lieut. James Waller, R.A.; Stanley Winn

Paper: Life on the upper Watut river, New Guinea. By Miss Beatrice Blackwood

Sixth Afternoon Meeting, 17 April 1939. The President in the Chair

Paper: The polar front and its place in modern meteorology. By Mr. C. K. M. Douglas

[1] Tinn, A. B., "Local temperature variations in the Nottingham district," *Quart. J.R. met. Soc.* 64 (1938) 391–405.

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Sir Darya (Jaxartes)
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Alai Mts.
Trans-Alai Mts.
Terek Pass
Waksh
Pamir Plateau
WAKHAN
Wakhjir Pass
Termez
Bactria
Akcha
Balkh
Mazar-i-Sharif
Tashkurghan
Kunduz
Khanabad
Faizabad
Baharak
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Bamiyan
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Begram (Kapisa)
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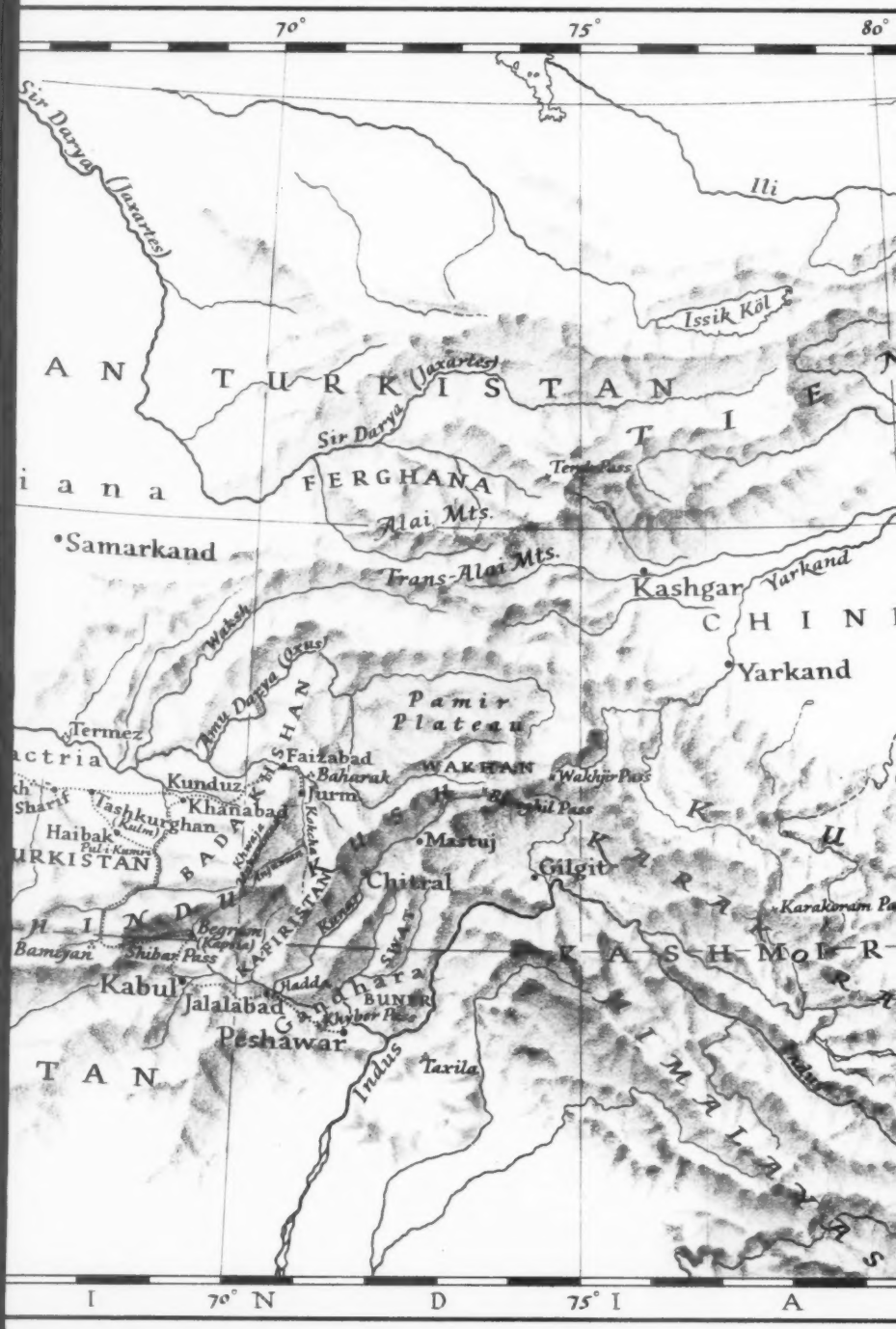
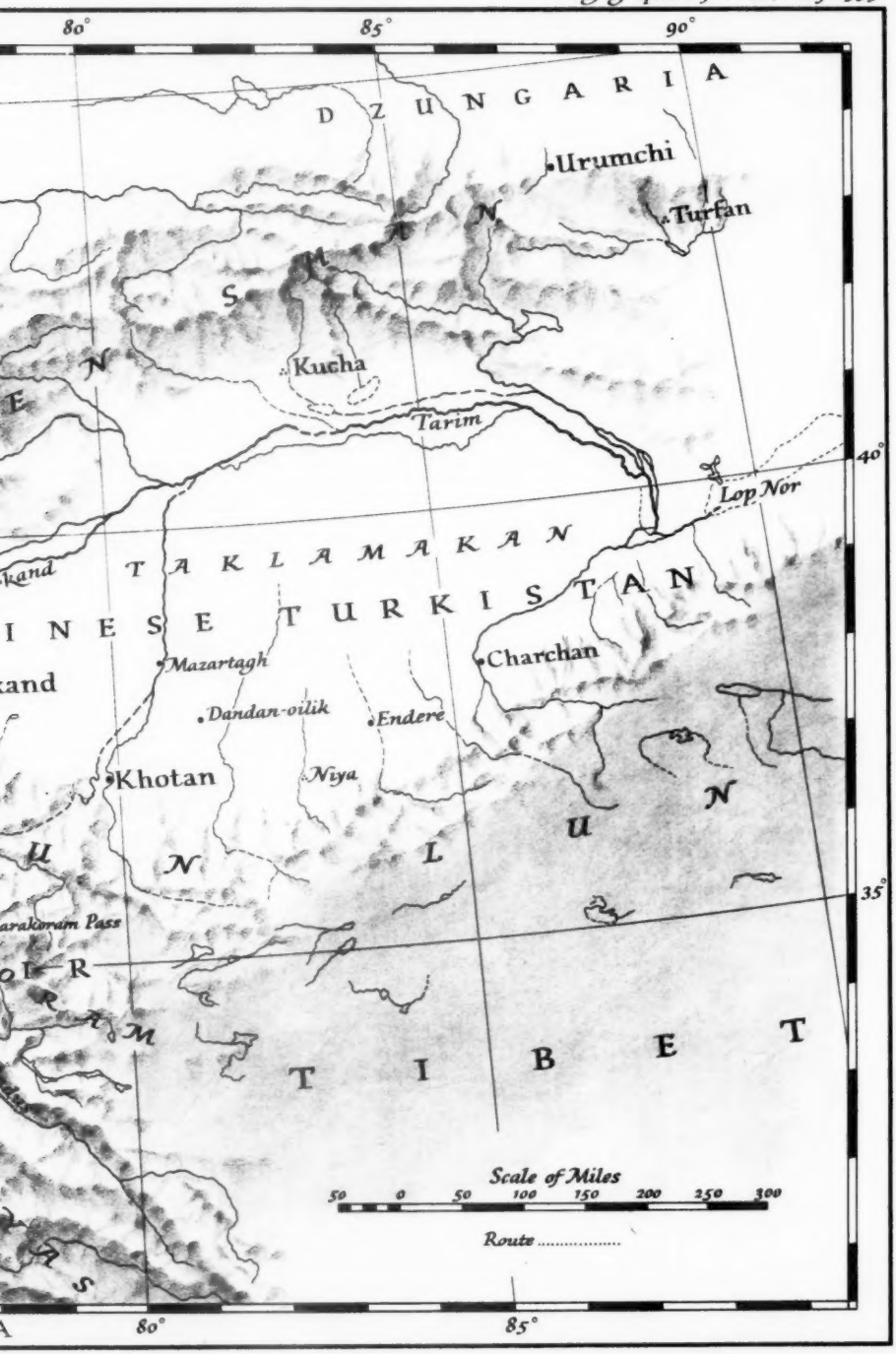
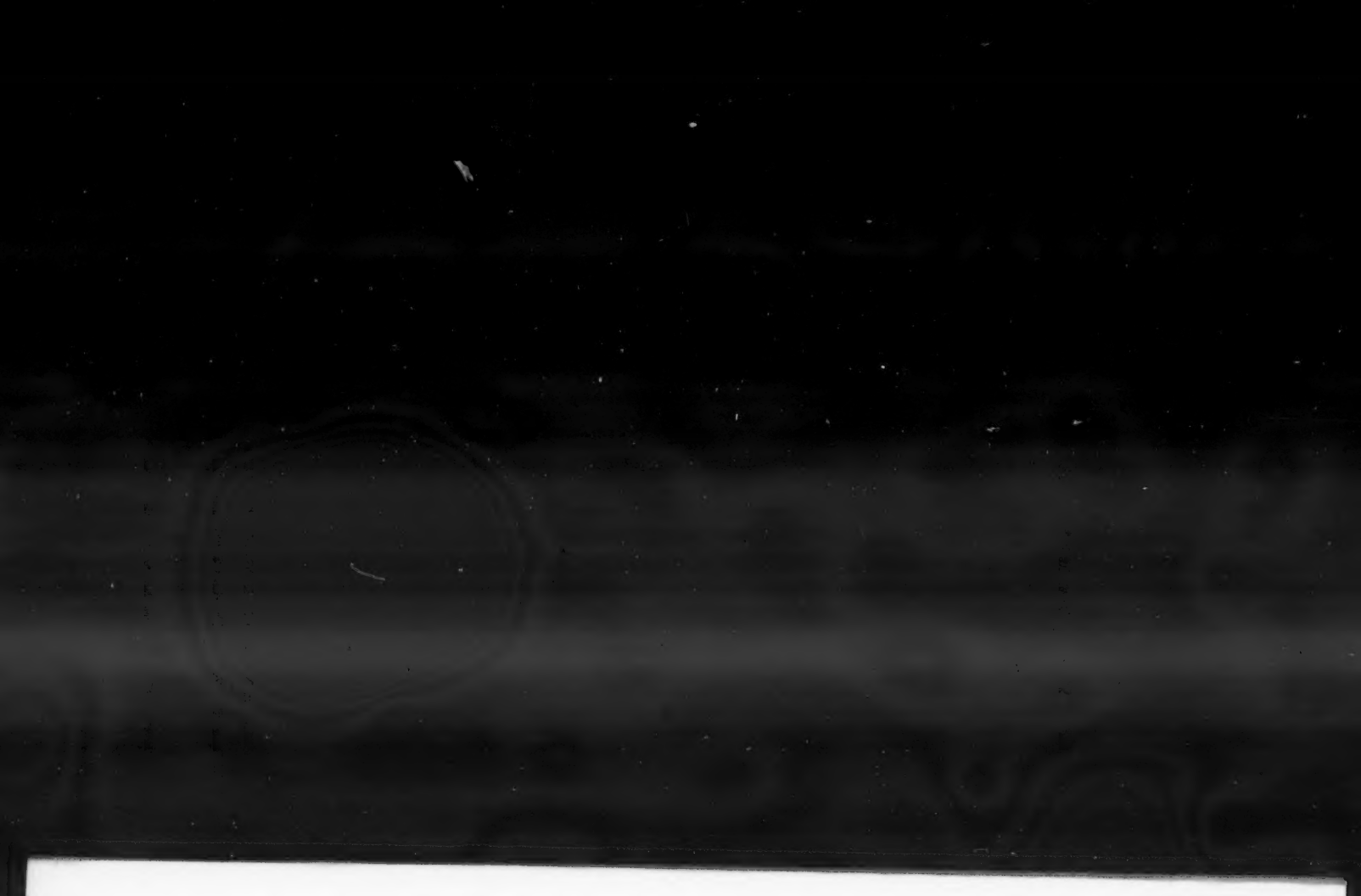
LORATION OF ANCIENT SITES IN NORTHERN AFGHANI

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